MODEL M525

LOWREY®

SERVICE MANUAL

Jubilee

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SPECIFICATIONS

LOWREY JUBILEE (Model M525)

The Jubilee is a self-contained spinet organ with two 44-note keyboards and a 13-note pedal keyboard. The organ is solid state (large scale integrated circuit and transistor). Three amplifiers drive three separate speaker channels.

UPPER KEYBOARD

Tabs

Trombone 16
Clarinet 16
Cornet 16
Kinura 8
Viola 8
Violina 4
Flute 16
Flute 8
Flute 4
Flute 2-2/3
Flute 2

Orchestral Presets

Activated one at a time except Trumpet Mute which is independent of the other Orchestral Presets.

Vibes
Vibra Harp
Harmonic Flute 4*
Harmonic Flute 2-2/3*
Piccolo
Piano
Violin
Harpsichord
Mandolin*
Banjo*
Accordion
Hawaiian Guitar
Trumpet Mute

* These Orchestral Presets will repeat when the Repeat tab is pressed.

Upper Keyboard Effects

Repeat - adds repeat effect to Banjo, Mandolin Harmonic 4 and 2-2/3 Orchestral Presets.

AOC - adds one-finger right hand chords to upper keyboard tab and Orchestral Presets.

Vibrato - affects all voices.

Upper Keyboard Controls

Sustain Control - adds sustain to upper keyboard voices.

Cancel Upper Button - cancels upper keyboard tabs when an Orchestral Preset is selected.

LOWER KEYBOARD

Tabs

Piano
Guitar
Banjo
Flute 8
Viola 8

Magic Melody Piano

Plays accompaniment counter-melody with selected rhythm (Rhythm 6 has highest priority). May be keyed from bass pedals or lower keyboard when Magic Chord tab is on.

SPECIFICATIONS

LOWER KEYBOARD (Continued)

Magic Genie Chords

Magic Genie Chord tab - enables Magic Genie.
A2 Keyswitch - adds seventh to Magic Chord (A2 key will not sound if pressed alone).

Minor Footswitch - changes major chord to a minor
A2 Key and Minor Footswitch changes Magic Chord to a minor seventh.

Key Note	Gives this Magic Genie Chord
A1	A Major
A#1	A #/B_b Major
B1	B Major
C1	C Major
C#1	C#/D_b Major
D1	D Major
D#1	D#/E_b Major
E1	E Major
F1	F Major
F#1	F#/G_b Major
G1	G Major
G#1	G#/A_b Major

Lower Keyboard Controls

Lower Medium tab
Lower Full tab

BASS

Pedal 16-8
Guitar Bass - adds guitar sound to pedal bass. When used with the Genie String Bass or Magic Swing Bass tabs adds guitar bass to these voices.

Genie String Bass - enables keyboard bass

Magic Swing Bass - enables Magic Swing Bass when used with rhythm. Plays one of 18 different patterns depending on selected rhythm (Rhythm 6 has highest priority). Keyed from Bass Pedals or from keyboard when Magic Chord tab is on.

Bass Control Tabs

Bass Medium
Bass Full
Pedal Sustain

STEREOPHASE SOUND

Main
Flutes
Tremolo
Celeste
Symphonic Chorus

TRACK III STEREO RHYTHM

Ballad
Dixie
Swing
Country
Swing Waltz
Waltz
Tango
Samba
Bosa Nova
Rhumba
Cha-Cha
Latin Rock
Rock
Hard Rock
Soft Rock
Disco
March
Metronome

Rhythm Controls

Rhythm Speed - also controls Repeat Speed
Rhythm Volume
Rhythm Balance - full down-drum; full up-brush
Downbeat - Intro/Break - flashes at downbeat
Pressing Button enables Intro pattern
Rhythm Auto Start - starts rhythm automatically when lower keyswitch or Bass Pedal is pressed. Stops automatically when all keys or pedal released.

GENERAL FEATURES

Reverb Length Control
Power On/Off
Photoelectric Expression Pedal
Glide Footswitch (Left side of expression pedal)
Auxiliary Input/Output Jacks (under organ, below lower right endblock) - for recording device
NOTE: A microphone will require an external preamp (not available from Lowrey)
Leslie Tone Cabinet Output Socket (on Power Supply Chassis)
Headphone Jack (accepts stereo or mono headphone)

DIMENSIONS

Height	40"
Width	48"
Depth	28"
Weight	275 lbs.

CIRCUIT DESCRIPTION

OVERVIEW

The Lowrey Jubilee (Model M525) incorporates three high frequency oscillator/synthesizer circuits to generate audio frequencies. The Tone Generator (Schematic 1) provides the upper and lower keyboard diode keyed tones. A phase-locked Loop and Divider generate the tones for the Magic Melody and Swing Bass (see Schematic 12). The Chord Function Generator and Pedal Bass frequencies are generated using a common oscillator (see Schematic 15).

Two types of keying are used in this instrument. Diode keying is used for the upper and lower keyboard voices (see Schematics 2 and 3). A keyboard scanning system is used for the lower keyboard Magic Genie Chords and Keyboard Bass (see Schematic 15).

The AOC feature (see Schematic 4) may be keyed from either of two sources. With the Magic Chord tab off, AOC information is applied to the AOC Drivers from the lower keyboard keyswitches (see Schematic 3). When the Magic Chord tab is on, serial data is decoded into AOC information which is applied to the AOC Drivers (see Schematic 15).

Active and passive filters are used to develop the tonality of the organ voices. The Flute filters are non-inverting, three pole active low pass filters (see Schematic 5). The String filters are passive filters (see Schematic 6). The filters used for the Reed/String Quality Control are non-inverting, active band-pass filters (see Schematic 8). The Magic Melody and Bass filters (see Schematics 13 and 14) are also active filters.

A two-phase Chorus Modulator is used for both the Flute and Reed/String voices (see Schematic 7).

The lighted button presets (see Schematic 9) are activated one at a time (except Trumpet Mute which is independent). Any combination of upper keyboard tabs and an Orchestral Preset may be used together. When the Cancel Upper button is pressed, the upper tabswitched voices will cancel and only the Orchestral Preset will be heard.

The Clock Multivibrator (see Schematic 11) provides clock pulses to drive the Repeat Modulator and the Rhythm Function Generator. The Rhythm Function Generator (RFG) is the source of all triggering pulses for the rhythm instrumentation, Genie and alternating bass. Serial data encoded with rhythm time point information is outputted from Pin 7 of the RFG. This data along with rhythm tab data is inputted to the Magic Melody and Swing Bass Read Only Memories (ROM). (See Schematic 12.)

Each rhythm time point causes the outputs of the ROM's to change. The output levels determine which notes of the Magic Melody and Swing Bass will be heard.

Audio signal from a selected bass pedal or Magic Chord (depending on the position of the Magic Chord tab) is applied to the reference input of a phase-locked loop (see Schematic 12). The comparator input is from a frequency divider. If the comparator input frequency is different from the reference frequency, a voltage is outputted from an internal voltage controlled oscillator (VCO) until the comparator input frequency is the same (in both frequency and phase) as the reference frequency.

The Divider (see Schematic 12) produces an octave of audio pitches where the root pitch is equal to the reference pitch. The pitches that are harmonically related (root, 3rd, minor 3rd, 5th, 6th, 7th, octave [8th]) are routed to the Magic Melody Keying circuits (see Schematic 13). Keying pulses from ROM 1 apply the audio signal (or audio signal divided-by-two) through a mixer to the Magic Melody filters where the tonality is developed. The audio is then amplified and applied to the output mixer. The outputs of the Divider are applied to the Swing Bass Note Select IC9. The Swing Bass output is determined by a three bit address code applied to IC9 from ROM2. The Swing Bass audio is divided and applied to the Bass Filters (see Schematic 14).

Depending on the position of the Swing Bass tab, either pedal or Swing Bass audio is keyed and applied to the Bass filters where the bass tonality is developed (see Schematic 14).

The CFG/Pedal Oscillator applies 500KHz to the Pedal Latch. The Pedal Latch outputs an audio frequency corresponding to the bass pedal being played. The lowest pedal pressed has priority. The pedal audio is routed to the Phase-locked Loop (see Schematic 12) where it provides the reference for the Magic Melody and Swing Bass (depending on the position of the Magic Chord tab) and to the Pedal Dividers (see Schematic 12).

The CFG/Pedal Oscillator frequency is divided in half and applied to the Chord Function Generator. Audio outputs from the CFG provide Magic Chord, High/Low (Root/Fifth) bass and Magic Melody reference signals. The Magic Genie AOC is decoded from serial data outputted from the CFG.

The audio outputs of the preamps are mixed together then routed to either of two volume regulators (see Schematic 10). The output from the volume regulators is applied to the crossover filters (see Schematic 17). The low frequency audio is routed to the bass amplifier via the bass low pass filter. A total of three power amplifiers are used in this instrument.

CIRCUIT DESCRIPTION

SCHEMATIC 1

TONE GENERATOR

TONE GENERATION

The Master Oscillator IC14 generates a 2 Megahertz (MHz) waveform which is applied to the Top Octave Synthesizer (T.O.S.) IC13. The T.O.S. is a divider. Each output changes state after counting a predetermined number of clock pulses from the master oscillator. The square waves outputted by the T.O.S. are the thirteen highest audio frequencies of the upper keyboard. The T.O.S. frequencies are applied to IC1-12. Each frequency is divided in half to produce a pitch one octave below the T.O.S. The divided output frequency is divided again to produce a lower octave pitch. This method of frequency division provides all keyboard pitches except Magic Melody and Swing Bass, Chord Function Generator and Bass Pedal.

Diode D1 rectifies the T.O.S. Master Oscillator frequency into a negative DC voltage when measured with a voltmeter. The vibrato signal modulates this voltage which in turn varies the amount of feedback in the tank circuit. This causes the Master Oscillator frequency to fluctuate at the rate of the Vibrato oscillator.

Pressing the glide switch applies a positive voltage to a 20K resistor, which causes the voltage at the anode of D1 to become less negative. This reduces the feedback of the tank circuit causing the T.O.S. Master Oscillator frequency to shift.

SCHEMATIC 2

UPPER DIODE KEYING AND DC CONTROL

UPPER DIODE KEYING

Pressing an upper keyboard keyswitch forward biases the keying diodes associated with that key. The audio signals are applied in groups to filters where wave shaping occurs.

SUSTAIN

Each time an upper keyboard keyswitch is pressed, a 47ufd capacitor associated with that key is charged. At key release, the capacitor discharges through a discharge switcher transistor and a diode to a negative voltage potential. If a positive voltage is applied to the base of Q18 by the Sustain Length Control or a preset voice which uses the sustain effect, Q18 and Q28 will be partially-to-completely biased off. This causes the voltage at the base of Q112 to become less negative which biases off Q112. The bases of the discharge switchers become less negative which partially biases the discharge switchers off. This slows the discharge rate of the capacitor which keeps the keying diodes forward biased for a short time after key release, giving the sustain effect. As the voltage on the base of Q18 becomes more positive, the sustain length increases.

ORCHESTRAL PRESET EFFECTS

Q27 KEYDOWN DETECTOR

When an upper keyswitch is pressed, the Upper Keydown Detector Q27 saturates which applies positive voltage to the effects connected to its collector. The effects will trigger only at initial keydown. All upper keys must be released before an effect can be triggered again.

IC2C, IC2D, Q19 SUSTAIN CANCEL TRIGGER, SWITCHER

The Orchestral Preset voices use a monophonic sustain effect. Each time an upper keyswitch is pressed, the sustain for the previously played note is cancelled. Selecting any lighted Orchestral Preset (except Trumpet Mute) will enable the sustain cancel trigger by applying a low to IC2D Pin 13. When any upper keys are pressed, a steady positive voltage is applied to IC2C Pin 8. Pin 10 switches low. IC2D momentarily senses this low through the .22ufd capacitor which causes its output to switch high for the duration of the pulse. This positive pulse causes Q19 to saturate which momentarily grounds any positive voltage applied to the sustain length regulator Q18. Q28 saturates, instantly discharging the sustain capacitors to the negative voltage at the emitter of Q28.

TRUMPET MUTE

Selecting the Trumpet Mute preset applies positive voltage from the Trumpet Mute Latch to the cathode of Diode D12, reverse biasing the diode. At keydown, a positive pulse is applied to the Keydown Reset Q15. Q15 is momentarily saturated. This insures that the .15ufd capacitor at the base of Q14 is discharged. The keydown causes the following sequence to occur:

1) The keydown pulse "sets" IC2A Pin 3 high.

2) This high level is applied through the Ramp Driver and charges the .15ufd capacitor at the base of Q14. This causes Q14 to gradually turn on, which turns on Q13.

3) The increasing ramp voltage "opens" a voltage-controlled filter which passes higher harmonics as the control voltage becomes more positive. This gives the "wa" part of the effect.

4) The ramp voltage is applied to the non-inverting input of a voltage comparator. When the ramp voltage exceeds the reference voltage at Pin 6 of IC1B, the comparator output switches positive. This "resets" IC2A Pin 3 low.

5) The .15ufd capacitor discharges to this low level gradually turning off Q14.

6) The decreasing ramp voltage "closes" the voltage-controlled filter which decreases the harmonic content of the audio. This gives the "ow" part of the effect.

TREMOLO

The Vibes, Vibra Harp and 16' Flute have a tremolo effect. The vibrato signal is used to drive a lamp which gates audio signal through a photocell at the frequency of the vibrato oscillator. The following occurs when either the Vibes or Vibra Harp preset is selected:

1) Positive voltage is applied from the selected latch to the Vibes/Vibra Harp Tremolo and Key-down Enable IC3D and to the Lamp Driver Enable Q29.

2) The output of IC3D switches low, turning off the 16' Main Flute Volume Switcher Q36 (see Schematic 5). This increases the signal level to the tremolo photocell.

3) IC3C inverts the low outputted by IC3D to a high level. The high level saturates Vibes/Vibra Harp Tremolo Switcher Q32 and enables the keydown pulse input to Photocell Lamp Driver Q6 by reverse biasing Diode D3.

4) Lamp Driver Enable Q29 saturates applying positive voltage to the base of Q6 and through Q32 (due to its saturated condition) to the collector of Tremolo Driver Q31.

5) Tremolo Driver Q31 is modulated by the Vibrato Oscillator which in turn modulates the voltage at the base of Q6.

6) A positive pulse is applied through a .33ufd capacitor to the base of Q6 to develop the tremolo keydown pulse when an upper keyswitch is pressed.

If the 16' Flute tab is pressed, Q29 is turned on and a steady positive voltage is applied to Q6 enabling the 16' Main Flute signal to pass unmodulated. Turning the Flute Chorus tab on ungrounds the input to 16' Main Flute Tremolo Switcher Q33 when the Chorus Selector Switch is in the Tremolo position. Switcher Q33 saturates causing the DC voltage applied to the Photocell Lamp Driver to be modulated by signal from the vibrato oscillator giving a tremolo effect to the 16' Main Flute.

VIBRATO

The Vibrato Oscillator IC1A applies a 6.25Hz sine wave to the tremolo driver, the CFG/Pedal Oscillator and through Vibrato Depth Adjust VR2 and the Vibrato tab to the Master Oscillator via Vibrato/Glide Driver Q1. Driver Q1 converts the vibrato signal into a low impedance, high current signal which is capable of shifting the Master Oscillator frequency.

Rhythm 'On' CFG Vibrato Killer Q3 saturates when a rhythm tab is turned on. This grounds the vibrato signal applied to the CFG/Pedal Oscillator.

VIBRATO EFFECTS

IC3A&B, Q23 VIBRATO DELAY TRIGGER, ENABLE

The Hawaiian Guitar, Vibra Harp, Piccolo and Violin presets use a delayed vibrato effect. The Vibrato Delay Trigger is enabled by grounding Pin 6 of IC3B through Vibrato Delay Enable Q23 when one of these presets is selected. At keydown, a positive voltage is applied to IC3A Pin 1 causing its output to switch low. IC3B momentarily senses this low through the .15ufd capacitor and its output switches high for the duration of the pulse. This positive voltage pulse causes Vibrato Delay Switcher Q5 to saturate which momentarily grounds the input to the vibrato oscillator.

NOTE: The Vibrato Delay for the Vibra Harp is applied to the Tremolo, resulting in a delayed tremolo effect.

Q5 VIBRATO DELAY SWITCHER

Transistor Q5 saturates when a positive voltage is applied to its base. This grounds the input to the vibrato oscillator, cancelling vibrato.

NOTE: When the Glide Switch is pressed, positive voltage is applied to the base of Q5, disabling the vibrato oscillator.

Q4, Q25, Q7 PRESET VIBRATO ENABLE & DEPTH SWITCHERS

The Hawaiian Guitar, Piccolo and Violin presets use a vibrato effect. Positive voltage is applied to the base of Q4 when one of these presets is selected. Q4 saturates which causes Q25 to cut off. This removes ground from the off buss of the Vibrato tab enabling vibrato signal to pass to the T.O.S. Master Oscillator.

The 4.7K and 3.3K resistors form a voltage divider which determines the preset vibrato depth. Selecting the Hawaiian Guitar preset causes Q7 to saturate. This bypasses a 47K resistor which increases the vibrato depth.

GLIDE

Pressing the Glide Footswitch (left side of expression pedal) applies positive voltage to the base of Vibrato/Glide Driver Q1. Q1 saturates which applies a low impedance, high current DC voltage to the Master Oscillator. This voltage reduces the feedback in the tank circuit and reduces the master oscillator frequency.

NOTE: Vibrato will be cancelled while the glide switch is pressed.

SLOW ATTACK

The Accordion, Piccolo and Violin presets enable the slow attack effect. Slow Attack Driver Enable Q24 saturates applying positive voltage to the Slow Attack Modulator Driver Q8. At keydown, the .068ufd capacitor charges which applies an increasing voltage to Q8. As Q8 turns on, it applies an increasing positive voltage to the Percussion/Slow Attack Modulator. This gates the audio through the modulator giving the slow attack effect. At key release, the capacitor discharges through a diode and a 47K resistor to ground via a 4.3K resistor at the emitter of Q27.

PERCUSSION [ONE SHOT]

Some of the preset voices use a one-shot percussion. The Harmonic Flute (4 & 2-2/3), Banjo and Mandolin will have a repeat percussion if the Repeat tab is on.

With the Repeat tab off and a percussion preset turned on, positive voltage is applied to the base of Q11. Percussion Drive Enabler Q11 saturates which causes Q10 to cut off. This ungrounds the output of Percussion Modulator Driver Q20. Percussion Keydown Detector Q26 is normally saturated holding Q20 off. Any keydown on the upper keyboard develops a positive pulse through the Keydown Detector to the base of Q20. Q20 saturates and applies a positive pulse to the Percussion/Slow Attack Modulator gating the audio through the modulator.

The percussion length is determined by the discharge time of the .56ufd capacitor at the base of Q20. The Banjo and Harmonic Flute (4 & 2-2/3) use a short percussion. Selecting one of these presets will cause Snub Switcher Q21 to saturate. This switches a voltage divider into the base circuit of Q20. The .56ufd capacitor will discharge to this snub voltage giving a short percussion.

PERCUSSION [REPEAT]

The Banjo, Mandolin or Harmonic Flute (4 & 2-2/3) presets will repeat if the Repeat percussion tab is pressed. The positive voltage is removed from Q11 (disabling the Percussion Modulator Driver) and applied to Q12. Q12 saturates, cutting off Q9 which enables pulses from the Percussion Repeat Modulator Driver to be applied to the Percussion/Slow Attack Modulator giving a repeat percussion effect.

SCHEMATIC 3

LOWER DIODE KEYING

There are 44 Lower Keyboard DC Keyswitches. Pressing a Lower Keyboard key applies voltage through a coil to the anode of Diode D5. This allows audio signal from the Tone Generators to pass to the 8-foot Lower Keyboard Diode Keying Groups. The Diode Keying Groups are represented by a bold line on Schematics 5 and 6.

Q111 ACCOMPANIMENT KILLER

With the Magic Chord tab on, the A1-A2 Lower Keyboard keys are disabled by Accompaniment Killer Q111. At this time the output from the Magic Chord preamp is routed to the Lower Keyboard filtering circuits. With the Magic Chord tab on, the A2 Lower Keyswitch becomes the 7th switch. Pressing the A2 Keyswitch at this time applies a positive voltage to 7th Enable IC24C which adds the 7th component to the Magic Genie Chord being played.

Q1 LOWER KEYBOARD KEYDOWN DETECTOR

The base of Q1 is normally high, keeping Q1 turned off. When a lower keyboard keyswitch is pressed, the base voltage is lowered and the transistor conducts applying a positive voltage to the Auto Start circuit.

SCHEMATIC 4

AUTOMATIC ORGAN COMPUTER [AOC]

Automatic Organ Computer (AOC) consists of Upper Keyboard AOC keyswitches (C1-C4), Lower Keyboard DC keyswitches (A1-C3), and in the Magic Chord mode the Magic Genie AOC Decoder is used in place of the first 12 DC keyswitches. Listed below is an example of what happens when a C Major chord is held on the Lower Keyboard and the C4 Upper Keyboard key is pressed.

1) With the AOC tabswitch on, holding a three-finger or a one-finger Magic C Major chord (C, E & G) on the Lower Keyboard applies positive voltage (from the A1-C3 Lower Keyboard keyswitches or the Magic Genie AOC Decoder) to the C, E & G AOC Drivers. Here the voltage is amplified and applied to the emitters of all the C, E & G AOC Keyers Q1-Q41.
2) Upon pressing the Upper Keyboard C4 Key:
   a) the C4 DC keyswitch contact (see Schematic 2) receives a positive voltage from its on buss and keys the C4 note through the Upper Keyboard Diode Keying circuitry.
   b) the C4 AOC keyswitch contact is grounded by its on buss which lowers the voltage on the base of nine AOC keyers - namely C#3, D3, D#3, E3, F4, F#4, G4, G#4 and A4. Since in this range only E3 and G4 have voltage applied to their emitters from the AOC Drivers, they are the only two AOC keyers that will conduct applying voltage to the Upper Keyboard E3 and G4 Diode Keying circuit. Thus, E3 and G4 will be heard along with C4.

Q86 AOC RANGE REGULATOR

The AOC Range Regulator applies voltage to the AOC drivers. The more positive the emitter voltage becomes, the wider the AOC keying range. When properly set, each AOC keyswitch will have a nine-note range.

SCHEMATIC 5

UPPER AND LOWER KEYBOARD FLUTE FILTERS

FLUTE FILTERS

Audio signal from the tone generators (via the upper and lower keyboard diode keying circuitry) is divided into groups of six to seven notes each called diode keying groups. Each group of notes is applied to a Flute filter where the Flute tonality is developed. The Flute filters are low pass filters tuned to pass only the fundamental frequencies of the waveforms applied to them.

FET SWITCHERS

The FET switchers are N-channel depletion mode devices (normally conducting). Each FET is pinched off when the voltage at the gate is less positive than the voltage at the source and drain. Turning on the tab associated with the FET applies positive voltage to the gate enabling the audio to pass to the Flute mixing preamp.

NOTE: The voltage to the upper Flute tabs is switchable and will be low when a lighted preset and the cancel upper buttons are pressed. The voltage to the lower Flute tabs is switchable and will be low when a rhythm tab and the Auto Start tab are pressed and the rhythm is stopped.

IC1A FLUTE MIXING PREAMP

The upper and lower keyboard Flute audio is amplified by IC1A. The output of the Flute mixing preamp is applied to the output mixer.

TREMOLO

The 16' Main Flute audio is applied to the input of the light dependent resistor (LDR) from the 16' Main Flute Collector Preamp IC1D. If the Vibes or Vibra Harp preset or 16' Flute tab is selected, modulated positive voltage is applied to the lamp, causing it to turn on. As the intensity of the lamp increases, the resistance of the LDR decreases. The audio signal is gated through P1 at the rate of the modulated voltage applied to the lamp giving the tremolo effect.

IC2D amplifies the modulated audio. The 16' Main Flute Volume Switcher Q36 is normally saturated which reduces the volume of the 16' Main Flute signal. If the Vibes or Vibra Harp preset is selected, Q36 turns off increasing the volume for these presets. The 16' Main Flute Preamp IC1C amplifies the main Flute signal before routing it to the Output Mixer (see Schematic 10).

IC1C, IC3D LOWER KEYBOARD FLUTE PREAMPS

Lower keyboard Flute audio is amplified by IC1C and applied to IC3D via the Lower Keyboard Flute Volume Switchers. The output of IC3D is applied to the Flute Mixing Preamp.

Q33, Q34 LOWER KEYBOARD FLUTE VOLUME SWITCHERS

Positive voltage is applied from the Lower Keyboard Flute Volume tabs to the bases of Q33 and Q34, saturating these transistors. Depending on which of the Lower Keyboard Volume tabs is on, voltage is removed from the base of one or both transistors. The resistance to ground at the output of the Lower Keyboard Flute Collector Preamp IC1C is varied regulating the amplitude of the signal applied to the Lower Keyboard Flute Preamp IC3D.

UPPER 4', 8' and 16' REED/STRING COLLECTOR PREAMPS

Audio signal from the diode keying groups is combined and applied to its associated collector preamp. Depending on the Reed/String tab or Orchestral preset selected, Reed/String Switcher Q37, Q32 or Q39 will be turned on. The outputs of the upper keyboard 4', 8' and 16' R/S collector preamps are applied to various Reed/String filters and through resistors to the 8' and 16' Harmonic Mixers.

IC2A&B 8' HARMONIC MIXER

Audio from the 4' and 8' R/S Collector Preamps is applied to the 8' Harmonic Mixer IC2B where the audio frequencies are mixed. The resultant audio is inverted through IC2A and applied to the 8' R/S Filters.

IC2C&D 16' HARMONIC MIXER

Audio from the 4', 8' and 16' R/S Collector Preamps is applied to the 16' Harmonic Mixer IC2C where the audio frequencies are mixed. The resultant audio is inverted through IC2D and applied to the 16' R/S Filters.

IC1B PERCUSSION PREAMP

Switching a 4' or 2-2/3' preset on applies audio to IC1B. IC1B amplifies this audio and routes it to the Percussion/Slow Attack Modulator.

SCHEMATIC 6

UPPER AND LOWER KEYBOARD STRING FILTERS

Passive filters are used for the upper and lower keyboard string voices. After being filtered, the upper 4' and 8' string audio is applied to collector preamps.

The FET's are pinched off when the gate voltage is less than the voltage at the drain and source. Switching a string tab on, applies positive voltage to an FET, gating the FET on and applying string signal to a preamp. The voltage for the upper string FET's is applied low by IC15 when the Cancel Upper and an Orchestral preset button are pressed together. This cancels the upper strings. The lower strings are disabled when the Auto Start circuitry is engaged but no lower keys are pressed.

The upper 4- and 8-foot string audio is applied to the Upper String Preamps IC2C and IC1D. The output of IC1D is routed to the Output Mixer. The lower 8-foot string audio is amplified by IC1A then routed to the Output Mixer.

SCHEMATIC 7

CHORUS MODULATOR

Audio signal from the Flute and Reed/String Preamps is applied to the Phase One and Phase Two Bucket Brigades. The audio signal is shifted through each bucket brigade at the frequency of the Voltage Controlled Oscillator (VCO). This causes a delay between the input and output signals, phase modulating the audio. The Chorus Output Low Pass Filters remove the high frequency clock component of the VCO. The phase modulated signal is applied to the Output Mixer where it is mixed with unmodulated audio signal.

HIGH SPEED, LOW SPEED OSCILLATORS, MIXER, INVERTER

Op amps use a split voltage supply. The op amp "sees" the +7.5 volt supply as ground. The Chorus Select Switch has three positions which affect the chorus as follows:

Tremolo:

1) Grounds the output of the Low Speed Oscillator (to +7.5 volts).
2) Applies the High Speed Oscillator Frequency (6.7Hz) through Mixer IC1B to the Phase One and Phase Two VCO. The signal applied to the Phase Two VCO is inverted from the Phase One signal. Therefore, as the frequency of one VCO is increasing, the other VCO is decreasing in frequency.

Celeste:

1) Grounds the output of the High Speed Oscillator (to +7.5 volts).
2) Applies the Low Speed Oscillator frequency (.33 Hz) to the Phase One and Phase Two VCO. The signal applied to the Phase Two VCO is inverted from the Phase One signal. Therefore, as the frequency of one VCO is increasing, the other VCO is decreasing in frequency.

Chorus:

1) The frequency of the Low Speed Oscillator is increased to .7Hz.
2) The amplitude of the High Speed Oscillator is reduced.
3) The two frequencies are mixed by IC1B and applied to both VCO's. The signal applied to the Phase Two VCO is inverted by IC2B. Therefore, as the frequency of one VCO is increasing, the other VCO is decreasing in frequency.

Q3-10 VOLTAGE CONTROLLED OSCILLATORS [VCO], ANTILOCK

As the amplitude of the voltage applied to the bases of the VCO transistors (Q3&4, Q5&6) changes, the frequency of the oscillator changes. The frequency varies between 166KHz and 550KHz.

It is possible for a VCO to stop oscillating. Should this occur, both VCO transistors would be saturated. This would apply a low to the base of Q7 (or Q9) causing Q8 (or Q10) to saturate. This grounds the bias voltage at the base of Q3 (or Q5) triggering the VCO back into oscillation.

IC3, IC4 BUCKET BRIGADES

The Bucket Brigade is an analog shift register which samples the input audio signal at the rate of the Clock pulses from the Voltage-Controlled Oscillator. Each time a clock pulse is applied to Pin 1 of IC3 (or IC4), the audio signal is transferred to the next stage of the Bucket Brigade until it appears as output. This causes a delay between the input and output signal. Since the frequency of the clock pulses are constantly varying, the delay time of the signal through the Bucket Brigade also varies, phase modulating the audio. The audio signal output from the Bucket Brigade is then applied to the Output Low-Pass Filter.

Q1, Q2 CHORUS OUTPUT LOW-PASS FILTERS

The output Low-Pass Filter filters out the high frequency clock component that is contained in the audio signal at the output of the Bucket Brigade. The filtered audio signal is applied to the Output Mixer.

SCHEMATIC 8

REED/STRING QUALITY CONTROL

Audio signal from the R/S collector amps is routed to various filtering circuits where the character of each voice is created. The output of each filter circuit is then routed through the Reed/String Preamp to the output mixer.

TRUMPET MUTE FILTER

This circuit is a state variable filter that acts in conjunction with the 800P capacitors to form an R-C low pass filter. The filter is voltage-controlled by the Trumpet Mute driver circuit (see Schematic 2). At keydown, a positive going ramp is applied to Pins 5 of IC1 and IC2. As the voltage becomes more positive, the harmonic content of the 16' R/S audio signal increases. This gives the "wa" effect to the Trumpet Mute voice. As the positive voltage decreases, the harmonic content decreases giving the "ow" effect. The output is a low impedance signal that is routed to the Trumpet Mute Preamp IC4D.

IC3, Q37 PERCUSSION/SLOW ATTACK MODULATOR, EMITTER FOLLOWER

Accordion, Violin and Piccolo Presets are the slow attack voices of the organ. Turning on any of these presets applies signal to the input of IC3. Signal is gated through IC3 when positive voltage is applied to Pin 5 from the Slow Attack Modulator Driver Q8 (see Schematic 2). This creates the Slow Attack effects for these voices. Banjo, Mandolin and Harmonic 4 & 2-2/3 are the repeat percussion voices of the organ. Turning on any of these presets applies signal to the input of IC3. Signal is gated through IC3 when positive voltage is applied from the Percussion Modulator Driver Q20 or the Repeat Drive Enabler Q9 to Pin 5 of IC3 (see Schematic 2). This creates the percussion and repeat percussion effects for these voices.

The Hawaiian Guitar, Harpsichord, Piano and Vibes use a solo (one shot) percussion to create the strike tone at keydown.

The output of the Emitter Follower Q37 is a low impedance signal which is applied directly to the Reed/String Preamp.

FET SWITCHERS

The FET switchers are N-Channel depletion mode devices (normally conducting). They are pinched off when the voltage at the gate is less positive than the voltage at the source and drain. Turning on the voice associated with each switcher applies a positive voltage to the gate of the FET, returning the FET to its unbiased state. This permits the audio signal to pass through the FET. The upper keyboard tabswitch voltage is switchable. When an orchestral symphonizer preset and the Cancel Upper button are pressed, the +14 volts to the upper tabs is switched low, cancelling the upper keyboard voices.

The tabswitch voltage for the lower Reed/String voices is supplied by the Rhythm Start/Stop Enable IC24. When the Auto Start tab and a rhythm tab are pressed (before a lower keyswitch is pressed), the switched voltage will be low. This disables the lower Reed/String voices until a lower keyswitch is pressed.

IC5 LOWER KEYBOARD MODULATOR

Audio signal from the Lower Keyboard R/S Filters is applied to the input of Modulator IC5. Here the signal is amplified. Signal can only pass through the Modulator when a positive voltage is applied to Pin 5 from the Lower Keyboard Modulator Driver. With no rhythm on, a steady positive voltage is applied to Pin 5 holding the Modulator on, allowing signal to pass through unmodulated. With a Rhythm Tabswitch on, positive voltage pulses are applied to Pin 5 from the Lower Keyboard Modulator Driver, gating the signal through the Modulator at the speed (tempo) of the rhythm. The signal is then applied to the Reed/String Preamp.

LOWER KEYBOARD ACCENT

The lower keyboard Guitar or Banjo will have an accent depending on the combination of Piano, Guitar and Banjo tabs selected (see Truth Table below). This accent is in addition to the normal lower keyboard modulation (see Lower Keyboard Modulator IC5).

LOWER TABSWITCH			Applied to MODULATOR	Applied to Modulator with ACCENT
Piano	Guitar	Banjo		
ON	ON	OFF	Piano	Guitar
ON	OFF	ON	Piano	Banjo
OFF	ON	ON	Guitar	Banjo
ON	ON	ON	Piano & Guitar	Banjo

Fig. 1 - Lower Keyboard Accent

With the rhythm off, Diodes D18 and D19 are reverse biased by positive voltage from IC25D Pin 8 applied through D9 and D16. This enables the lower keyboard Guitar and Banjo switchers to be gated on when the associated tab is pressed.

The following conditions must be met to enable the Lower Keyboard Accent circuit:

1) At least two of the lower keyboard Piano, Guitar or Banjo tabs must be pressed.
2) The rhythm must be playing.

When the rhythm is playing, the input from IC25D Pin 8 is low. This enables positive pulses from ROM 2 to be applied to the cathode side of D18 and D19 through Buffer IC8E. Depending on the tabs selected, steady positive voltage may be applied to the cathode of D18 from IC25E or D4. This disables the accent for the Lower Keyboard Guitar. As the pulses from ROM 2 are applied to the cathode of D18 or D19 the tabswitch voltage is modulated. The FET switcher gates audio signal through the FET. This results in an accented voice in addition to the normal lower keyboard modulation.

Q26, Q27 LOWER KEYBOARD REED/STRING VOLUME SWITCHERS

When the Lower Volume tabs are off, Q26 and Q27 are saturated. A voltage divider is formed between the 6.8K resistor (emitter Genie Modulator Driver Q8 - see Schematic 11) and the 2K resistor to ground (through Q26). Resistors are added to the voltage divider when the Lower Medium or Lower Full tab is switched on, raising the junction of the 6.8K and 2K resistors higher above ground. This increases the voltage into the Lower Keyboard Modulator, increasing the volume of the lower R/S voices.

IC4A REED/STRING MIXING PREAMP

The upper keyboard Reed/String voices (except percussion and slow attack voices) are amplified by IC4A. The amplified signal is then applied to the Reed/String Preamp.

IC4C REED/STRING PREAMP

The upper and lower keyboard Reed/String voices are amplified by IC4C. The audio signal is then routed to the Output Mixer.

SCHEMATIC 9

LIGHTED BUTTON LOGIC

PRESET LATCHES

Each lighted pushbutton switch uses a latch circuit to enable the audio and effects for the chosen preset. One preset can be enabled at a time except for the Trumpet Mute and Cancel Upper Latches which are independently activated and cancelled.

POWER ON RESET

At power turn on, the .27ufd capacitor appears to be a short to the DC voltage. This applies a positive voltage to Inverter IC14A. Its output switches low which:

1) causes the Presets Cancel Triggers to activate applying a reset pulse to the latches.

2) is inverted to a high by IC14D and resets the Rhythm Intro circuit and the Cancel Upper and Trumpet Mute latches.

CIRCUIT DESCRIPTION

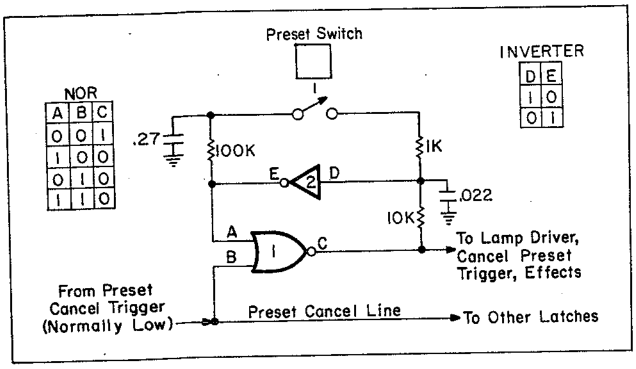

Preset Switch
INVERTER
D E
1 0
0 1
NOR
A B C
0 0 1
1 0 0
0 1 0
1 1 0
.27
100K
1K
E
2
D
.022
10K
A
B
1
C
To Lamp Driver, Cancel Preset Trigger, Effects
From Preset Cancel Trigger (Normally Low)
Preset Cancel Line
To Other Latches

Fig. 2 - Typical Preset Latch

ACTIVATING A PRESET [See Fig.2]
A positive pulse is applied from the preset cancel trigger to Pin B of IC1 at organ turn on. This ensures that the output of the latch (Pin C) will be low. This low is inverted through IC2 and applied as a high to Pin A which latches Pin C low. Pin E applies a positive voltage potential to the .27ufd capacitor. Pressing the preset switch applies this positive potential to Pin D of IC2. The voltage is inverted to a low. Because both inputs to IC1 are now low, its output switches high. This high level is inverted to a low by IC2 and applied to Pin A which will latch Pin C high. This positive voltage enables the lamp, the audio switcher and any effects (percussion, slow attack, etc.) associated with the selected preset.

CANCELLING A PRESET [See Fig.2]
Once the preset is activated, a low voltage potential is present at the .27ufd capacitor. If the active preset switch is pressed again, the high level at Pin D will switch to the low potential at the capacitor. Pin E will switch high causing Pin C to switch low. This latches Pin C low by applying this low back to Pin D.

CHANGING PRESETS [See Fig. 3]
Only one Orchestral preset can be activated at a time (except Trumpet Mute). The active preset applies positive voltage to the base of Q32. This voltage is too low to saurate Q32. If a second preset is pressed, the combined voltages from both presets will saturate Q32. Q33 saturates applying a high to the preset cancel line and IC14C. The output of IC14C switches low. Pin 6 of IC15B momentarily senses this low and a positive pulse is outputted from Pin 4. This cancels the first preset (see example Fig. 2) which removes one of the voltages applied to Q32 turning this transistor off. The preset cancel line switches low at the end of the reset pulse.

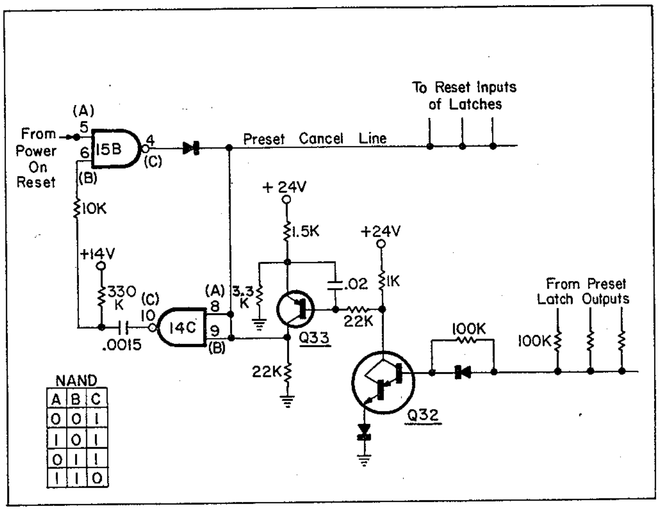

To Reset Inputs of Latches
(A)
From Power On Reset
5
6
15B
4
(C)
(B)
Preset Cancel Line
+24V
10K
+14V
1.5K
+24V
330 K
(C)
10
14C
.0015
(A)
8
9
(B)
3.3 K
.02
1K
22K
Q33
22K
From Preset Latch Outputs
100K
100K
Q32
NAND
A B C
0 0 1
1 0 1
0 1 1
1 1 0

Fig. 3 - Preset Cancel Trigger

CANCEL UPPER

Any combination of upper keyboard tabs may be used with an Orchestral Preset. When the Cancel Upper button is pressed, the Orchestral Presets will be heard and the upper tabs will be cancelled. **NOTE: The Cancel Upper button will not cancel the Trumpet Mute preset. The upper tabs will not cancel if the Trumpet Mute and the Cancel Upper buttons are pressed together.**

Pressing the Cancel Upper button applies a low to the enable input of IC13C Upper Tabswitch Cancel Enable and IC13D DC Keying Cancel Enable.

The following sequence occurs when the Cancel Upper and an Orchestral Preset button are pressed:

1) A low is applied from the Cancel Upper Latch to one input of the Upper Tabswitch Cancel Enable (IC13C Pin 9).
2) A positive voltage is applied from the lamp driver transistor of the active Orchestral Preset to the base of Orchestral Preset 'On' Detector Q31.
3) Q31 saturates which applies a low to Upper Tabswitch Cancel Enable IC13C Pin 8.
4) The output of IC13C (Pin 10) switches high (because both inputs to IC13C are low).
5) Pin 12 of Upper Keyboard Tabswitch Bus Driver IC15D is high. Since both inputs to IC15D are high, the output Pin 11 switches low. This removes voltage from the upper tabswitches cancelling the upper keyboard voices.

SCHEMATIC 10

OUTPUT MIXER

The outputs of all the preamp circuits are applied to the Output Mixer. The audio signals are mixed together then routed to either of two volume regulators. The outputs of the volume regulators are amplified before being applied to the crossover filters.

IC2D MAIN MIXING PREAMP

The upper and lower keyboard Flute and Reed/String audio is applied to the Main Mixing Preamp IC2D. Here the signals are mixed and amplified then routed to the Main Volume Regulators or the Chorus Mixing Preamp depending on the position of the Main or Flutes Chorus tab.

IC2C CHORUS MIXING PREAMP

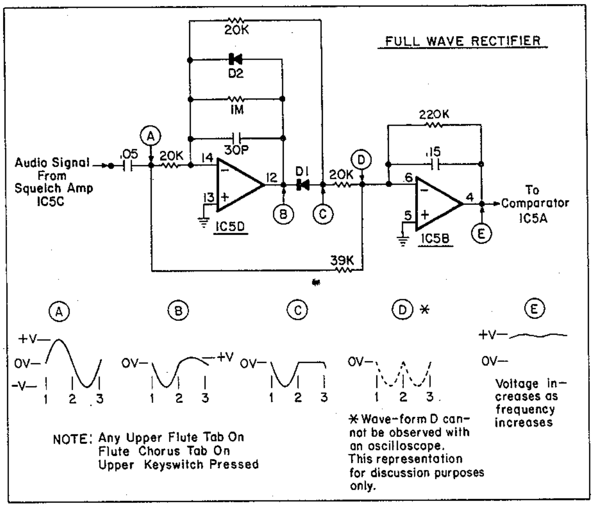
Upper and lower keyboard Flute and Reed/String audio is applied to the Chorus Mixing Preamp IC2C when the associated Chorus (Main or Flute) tabswitch is in the "on" position. The Main, Flute and Reverb signals are mixed then applied to the Chorus Modulator and the Squelch Amplifier.

CHORUS MODULATOR SQUELCH

The Squelch Amp, Full Wave Rectifier, Comparator, Buffer and Squelch Switchers ground the outputs of both chorus phases when there is no audio signal applied through the chorus modulator circuits. This is to silence the inherent noise that is generated by the chorus modulator.

IC5C SQUELCH AMP

The audio signal outputted by the Chorus Mixing Preamp is amplified by Squelch Amp IC5C and applied to the Full Wave Rectifier.



NOTE: Any Upper Flute Tab On
Flute Chorus Tab On
Upper Keyswitch Pressed

* Wave-form D cannot be observed with an oscilloscope. This representation for discussion purposes only.

Fig. 12 - Squelch Audio Rectifier

IC5B, IC5D FULL WAVE RECTIFIER [See Fig. 12].

Integrated circuit IC5 is using a split supply (B+ = +14V, B- = -14V). The non-inverting (+) inputs to IC5B and IC5D are grounded referencing the outputs to ground potential when no audio signal is applied to the input (which also 'sees' ground).

When audio signal is applied to the inverting (-) input, Pin 14 of IC5D, the following sequence occurs:

1) During the positive half cycle of the input, Diode D2 is reverse biased. The output half cycle (Pin 12) goes negative and has high gain. See Fig. 12, Waveforms A and B point 1 to 2.
2) As the input waveform passes through zero and goes negative, the output (Pin 12) goes positive.
3) During the negative half cycle of the input waveform, Diode D2 is forward biased. Since a forward biased diode has very low resistance, there is low gain. See Fig. 12, Waveform B, point 2 to 3.

The output of IC5D Pin 12 is applied through Diode D1 to Pin 6 of IC5B. Diode D1 becomes reverse biased if the output of IC5D (Pin 12) should become positive. This prevents the waveform from going positive. See Fig. 12, Waveform C.

The input Waveform (A) and the rectified Waveform (C) are summed together and applied to Pin 6 of IC5B. See Fig. 12, Waveform D. IC5B inverts and filters the Waveform into a positive DC voltage. The DC level becomes more positive as the frequency increases. This DC voltage is applied to Comparator IC5A.

IC5A COMPARATOR

The non-inverting (+) input to Comparator IC5A is a positive DC voltage. Since there are no feedback components used in the comparator, the output (Pin 4) swings to the positive rail (+14 volts). This voltage reverse biases Diode D7. The Full Wave Rectifier IC5D & 5B outputs a positive voltage when audio signal is applied to the rectifier. When this voltage exceeds the reference voltage (Pin 2 of IC5A) the Comparator output swings to the negative rail (-14 volts). Since the anode of Diode D7 is now more positive than the cathode, D7 becomes forward biased.

Q9, Q6 and Q7 BUFFER, SQUELCH SWITCHERS

When there are no keyswitches pressed, Diode D7 is reverse biased. Buffer Q9 has a positive voltage applied to its base keeping this transistor turned on. The voltage at the emitter of Q9 is applied to the Squelch Switchers Q6 and Q7 turning them on. This grounds the outputs of the chorus modulator to silence any inherent noise generated by the chorus modulator.

When audio signal is applied to the Chorus Modulator, it is rectified into a positive DC voltage and applied to the inverting (-) input of Comparator IC5A. This causes the output to swing to the negative rail (-14V). The positive voltage at the base of Q9 is routed through D7 to -14 volts at Pin 3 of IC5A. This causes Q9 to cut off which cuts off the Squelch Switchers. When the Squelch Switchers cut off, the chorus modulator output is applied to the volume regulators.

IC3, IC2A REVERB LIMITER, DRIVER

The Reverb Limiter IC3 has a control input at Pin 5. Initially, Limiter Driver Q4 is cut off. This 'opens' the control input of IC3 to its maximum amount. Audio signal is applied through IC3 and is amplified by Reverb Driver IC2A. The audio is then applied:

1) through the reverb spring to the Reverb Recovery Amp IC2B where the audio is amplified and
2) to the Reverb Limiter Driver Q4.

This audio is equally distributed to both volume regulators via the Reverb Length Control.

Q4 REVERB LIMITER DRIVER

The audio signal outputted by the Reverb Driver is rectified into a positive voltage by Diodes D6 and D3. This positive voltage turns on Q4 which reduces the positive voltage applied to the control input of IC3. Therefore, as the amplitude of the signal applied to the reverb spring increases (due to more keys or tabs being pressed), the positive voltage applied to the Limiter Driver Q4 increases, causing Q4 to turn on harder. The DC voltage level applied to the control input of the Reverb Limiter is reduced which limits the total signal applied to the reverb spring to a constant level.

Q21 VOLUME REGULATOR DRIVER

The amplitude of the signal at the output of the volume regulators is controlled by the Volume Regulator Driver Q21. Pressing the expression shoe down opens the shutter in the Expression Pedal Photocell, decreasing the photocell's resistance, which increases the voltage on the base of Q21. This in turn increases the emitter voltage of Q21. Applying this voltage to Pin 5 of the volume regulators increases the amplitude of their output signal.

REVERB

All audio signal (except 16' Main Flute) is applied through the Reverb circuit to both Volume Regulators.

VOLUME REGULATORS, OUTPUT AMPS

The left channel rhythm and Chorus Phase One signals are applied to Volume Regulator Two. The right channel rhythm, 16 foot Main Flute and Chorus Phase Two signals are applied to Volume Regulator One. The Flute, Reed/String, Bass, Reverb, Chorus Phase Three and auxiliary input signals are applied to both volume regulators. The outputs of the Volume Regulators are applied to the Output Amps where the signal is applied as a low impedance to the crossover filters.

SCHEMATIC 11
RHYTHM

IC27 RHYTHM FUNCTION GENERATOR

The Rhythm Function Generator (RFG) IC27 is the source of all triggering pulses for the rhythm instrumentation, Genie and alternating bass. Serial data encoded with rhythm time point information is outputted from Pin 7 of the RFG. (See Fig. 7 for example of time point data). This data along with rhythm tab data is applied to the Magic Melody and Swing Bass Read Only Memories (ROM) where the triggering pulses for the Magic Melody and Swing Bass are developed.

The RFG is enabled by applying a low to Pin 26 (see Rhythm Start/Stop). Pressing a Rhythm tabswitch applies a positive voltage to the RFG. This enables the logic sequence for the rhythm chosen.

The Track Select switch performs three functions:

1) It determines the Rhythm pattern that will be heard with a particular Rhythm by selecting the track that the logic sequence will follow.

2) It reduces the Clock Multivibrator speed for the Track A patterns by placing a .047uf capacitor in parallel with the .15uf feedback capacitor.

3) When the Ballad is selected (Track A, Rhythm 1) a high level is applied to the Ballad Intro 'On' Detector.

The outputs of the RFG are positive pulses which are applied to the Instrumentation, Bass and Lower Keyboard Modulator circuits. Track A patterns 1 through 4 are triplet rhythms (24 time points). Patterns A5 and A6 are 3/4 rhythms (18 time points). All other rhythms are in 4/4 time (32 time points). (See Rhythm Pattern Charts.)

IC21A, IC21B CLOCK MULTIVIBRATOR

The Clock Multivibrator oscillates at a speed which is controllable from approximately 3 to 44 Hz. Outputs of the Clock Multivibrator are applied to the Repeat Modulator Driver and through Ballad Intro Divider IC29A to the Rhythm Function Generator and to the Rhythm Time Point Shift Register (see Schematic 12).

IC29A, IC20D BALLAD INTRO DIVIDER, DIVIDER ENABLE

Normally, Pin 12 of IC20D Divide-by-Two Enable is low. IC20D functions as an inverter. Each time the Clock Multivibrator output (Pin 4 of IC21B) goes low, a negative going pulse is developed across a .001uf capacitor connected to Pin 13 of IC20D. With each negative going pulse applied to Pin 13 a positive pulse is outputted from IC20D to the set input of IC29A. This causes the Q output to switch high and the Q-bar output to switch low. The next positive going edge of the Clock Multivibrator clocks IC29A causing the Q output to switch low (because the Q-bar output is connected to the D input of IC29A). The result is that the Q-bar output is changing in phase with the clock input (Q-bar goes high when Clock Multivibrator output goes high).

IC22D BALLAD INTRO 'ON' DETECTOR

When the Ballad rhythm is selected (Track A, Rhythm 1) and the Intro button is pressed, both inputs to IC22D, Ballad Intro 'On' Detector are high. The output of IC22D switches high which disables IC20D. The output of IC20D switches low which enables Ballad Intro Divide-by-Two Divider IC29A to function as a divider. This reduces the speed of the intro pattern when the Ballad rhythm is selected.

CIRCUIT DESCRIPTION

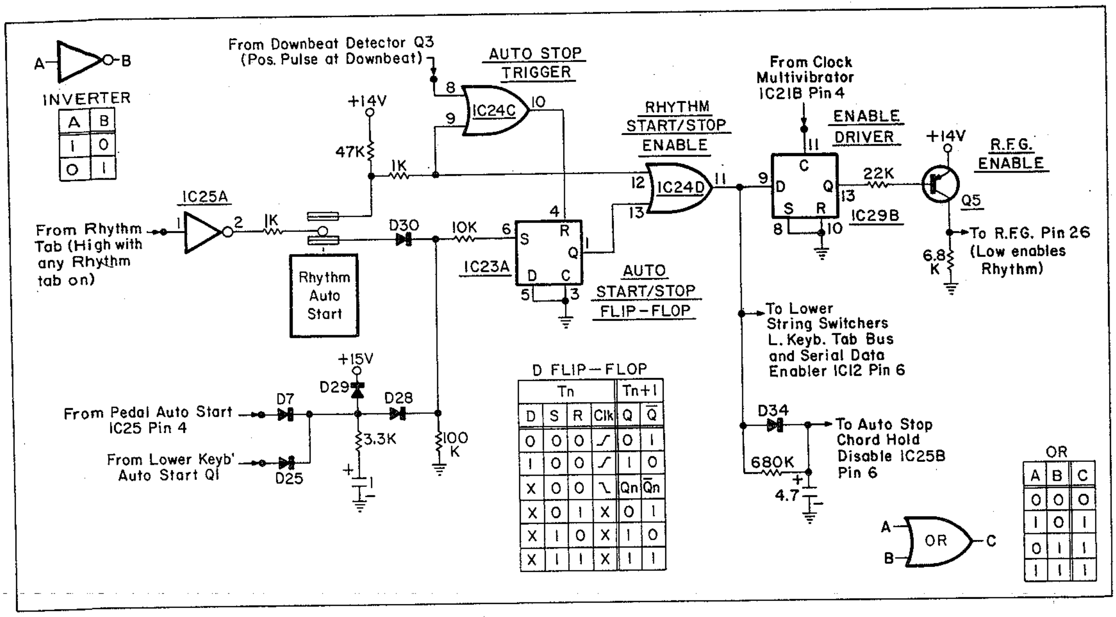

A
B
INVERTER
A B
1 0
0 1
From Downbeat Detector Q3 (Pos. Pulse at Downbeat)
AUTO STOP TRIGGER
8
9
IC24C
10
+14V
47K
1K
IC25A
From Rhythm Tab (High with any Rhythm tab on)
1
2
1K
Rhythm Auto Start
D30
10K
6
S
R
4
Q
1
IC23A
D
C
5
3
AUTO START/STOP FLIP-FLOP
RHYTHM START/STOP ENABLE
12
13
IC24D
11
From Clock Multivibrator IC21B Pin 4
ENABLE DRIVER
11
9
D
C
Q
13
S
R
8
10
IC29B
22K
+14V
R.F.G. ENABLE
Q5
To R.F.G. Pin 26 (Low enables Rhythm)
6.8K
To Lower String Switchers L. Keyb. Tab Bus and Serial Data Enabler IC12 Pin 6
D34
To Auto Stop Chord Hold Disable IC25B Pin 6
680K
4.7
+15V
D29
D28
D7
From Pedal Auto Start IC25 Pin 4
From Lower Keyb' Auto Start Q1
D25
3.3K
100K
1
D FLIP-FLOP
Tn
Tn+1
D S R Clk Q Q̄
0 0 0 ⌐ 0 1
1 0 0 ⌐ 1 0
X 0 0 ⌐ Qn Q̄n
X 0 1 X 0 1
X 1 0 X 1 0
X 1 1 X 1 1
OR
A
B
OR
C
A B C
0 0 0
1 0 1
0 1 1
1 1 1

Fig. 4 - Rhythm Auto Start

Q7 REPEAT MODULATOR DRIVER

The negative going edges of the pulses outputted at IC21A Pin 2 develop negative pulses across a .033uf capacitor. These pulses are inverted by IC21F and applied as positive pulses to the base of Q7. This repeatedly turns Q7 on, creating a series of positive output pulses at its emitter. These positive output pulses are then routed to Pin 5 of the Percussion/ Slow Attack Modulator via the Percussion Repeat Drive Enabler where they gate signal through the modulator at the speed of the rhythm and create the repeat effect for the Mandolin, Banjo and Harmonic Flute voices.

RHYTHM START/STOP

The rhythm can be started normally by turning on a Rhythm switch or automatically by: 1) Placing the Rhythm Start Normal/Auto tab to Auto, 2) Turning on a Rhythm switch and 3) Pressing a lower keyboard key or a bass pedal. The rhythm pattern will then stop automatically after all lower keyboard keys and Bass Pedals are released.

Normal [See Fig. 4]

The data input to Enable Driver IC29B is normally high. Pulses from the clock multivibrator are applied to the clock input of IC29B. Because the data input is high, the Q output of IC29B will be high. This high level cuts off RFG Enable Q5 which applies a low to the enable input (Pin 26) of the RFG. This enables the RFG. When a rhythm tab is pressed, positive voltage is applied to the associated rhythm input of the RFG. The RFG outputs the rhythm sequence as long as a rhythm tab is on.

Auto Start [See Fig.4]

When the Rhythm Start tab is in the Auto position, the initial conditions are as follows:

1) The set input to Auto Start/Stop Flip-Flop IC23A is low (because at this time a pedal or lower keyswitch has not been pressed).
2) A high is applied to the reset input of Auto Start/Stop Flip-Flop IC23A via Auto Stop Trigger IC24C. This resets the Q output of IC23A low.
3) Pressing a rhythm tab applies a high to the Inverter IC25A which makes its output low.
4) The low outputted by IC25A is applied to the reset input of Auto Start/Stop Flip-Flop IC23A via Auto Stop Trigger IC24C. The Q output of IC23A will remain low.
5) Both inputs to Rhythm Start/Stop Enable IC24D are now low. (Q output of IC23A and the output of Inverter IC25A). The output of IC24D will be low.
6) A low is clocked through Enable Driver IC29B which causes RFG Enable Q5 to saturate. This applies a high to the RFG which disables the rhythm.
7) The low output of IC24D disables the chord hold function of the CFG, the lower keyboard strings, the lower keyboard tabs, and the data input to the Magic Genie AOC Decoder.

Under the above conditions no rhythm, Magic Chords, Magic Melody, Swing Bass or Genie Bass will be heard.

Pressing a lower keyboard key or bass pedal causes the following sequence to occur:

1) Positive voltage is applied from the Lower Keyboard or Pedal Auto Start circuits to the set input of IC23A causing the Q output to switch high.
2) This high is applied through Rhythm Start/Stop Enable IC24D to the D input of IC29B and enables the chord hold function of the CFG, the lower keyboard strings, the lower keyboard tabs and the data input to the Magic Genie AOC Decoder.
3) The high is clocked through IC29B which causes RFG Enable Q5 to cut off. This makes the enable input to IC27 low which enables the rhythm.

The rhythm pattern will be outputted as long as a lower keyswitch or bass pedal is pressed.

Auto Stop [See Fig. 4]

The enable input to the Rhythm Function Generator (Pin 26 of IC27) is an in/out port. When Pin 26 is applied low, the RFG is enabled. At each downbeat, Pin 26 of the RFG outputs a positive sync pulse. At key release, the rhythm will continue to play. The Magic Chord, Magic Melody, Swing Bass or Genie Bass will continue to play if they are enabled.

When the rhythm pattern reaches the downbeat, the following sequence occurs:

1) A positive sync pulse is outputted from Pin 26 of the RFG. The negative going edge develops a pulse across a .01 capacitor that is applied to the base of Q3 Downbeat Detector.
2) The collector of Q3 outputs a positive pulse which is applied via IC24C to the Reset input of IC23A. Because the Set input to IC23A is low (due to the release of the lower keyboard keys), the Q output resets low.
3) The low at the Q output of IC23A is applied through IC24D to the D input of IC29B.
4) A low is clocked to the Q output of IC29B which causes Q5 to saturate. This applies a high to the RFG disabling the rhythm.
5) The low output of IC24D disables the chord hold function of the CFG, the lower keyboard strings, the lower keyboard tabs, and the data input to the Magic Genie AOC Decoder.

Q3 DOWNBEAT DETECTOR

When the Rhythm Function Generator is enabled, Pin 26 is applied low. At each downbeat, Pin 26 outputs a positive sync pulse. The negative going edge develops a pulse across a .01uf capacitor. This causes Q3 to momentarily saturate and output a positive pulse at its collector. This positive pulse is applied to the Downbeat Lamp Driver, Intro Lamp Driver and Auto Stop Trigger.

Q2 INTRO & DOWNBEAT LAMP DRIVER

Each time a positive pulse is outputted from Downbeat Detector Q3, Intro & Downbeat Lamp Driver Q2 will momentarily saturate. This causes the Downbeat Lamp to flash at each downbeat. If the Intro button had been pressed, a steady posiive voltage would be applied from Intro Lamp Driver Latch IC23B to the base of Q2, holding the lamp on for the duration of the intro pattern.

IC22C, Q33 RIM SHOT ENABLE, LOW DRUM KILLER

When the Rhythm 3 tab is pressed, positive voltage is applied to the base of Q33. Q33 saturates, grounding the input to the Low Drum Generator. The Rhythm 3 tab applies positive voltage to Pin 9 of Rim Shot Enable IC22C enabling this gate. When RFG Pin 8 outputs a pulse, it is applied through IC22C to the Rim Shot Generator.

IC28D, Q12 RHUMBA BRUSH SNUB ENABLE, SWITCHER

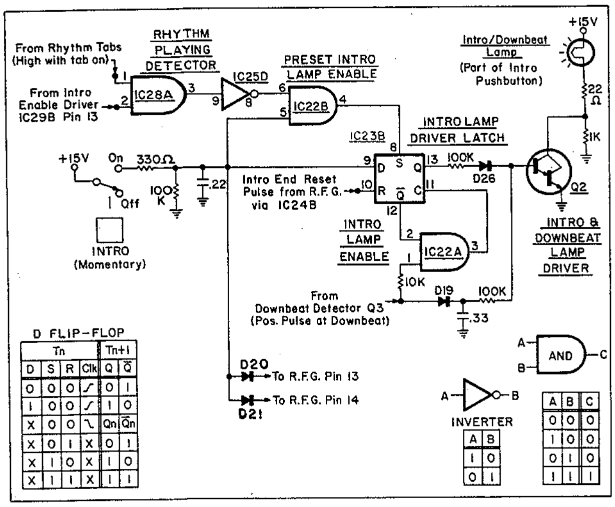
When the Rhumba rhythm pattern (Track B, Rhythm 4) is selected, both inputs to Rhumba Brush Snub Enable IC28D will be high, switching the output high. This causes Snub Switcher Q12 to saturate which reduces the amplitude of the brush keyer pulse (RFG IC27 Pin 22).

IC25F POWER ON RESET

At power turn on, a positive pulse is applied to the reset input of Intro Lamp Driver Latch IC23B (via Intro End Reset IC24B) to ensure the Intro lamp will be off. IC25F inverts the power on reset pulse and applies it to the Rhythm and Magic Chord 'On' Detector (see Schematic 12).

INTRO [See Fig.5]

Each time the Intro button is pressed, positive voltage is applied to pins 13 and 14 of the RFG which resets the RFG and enables the intro sequence. The intro pattern will repeat as long as the intro button is pressed and held. If the Intro button is pressed and released, the intro sequence will play to its conclusion and then play the selected rhythm. The position of the Rhythm Select Switch determines the Intro Pattern that will be heard. Tracks B and C play Intro I and Track A plays Intro II.


From Rhythm Tabs (High with tab on)
RHYTHM PLAYING DETECTOR
From Intro Enable Driver IC29B Pin 13
IC28A
IC25D
PRESET INTRO LAMP ENABLE
IC22B
Intro/Downbeat Lamp
(Part of Intro Pushbutton)
+15V
22 Ω
1K
IC23B
INTRO LAMP DRIVER LATCH
+15V
On
Off
330Ω
100 K
.22
INTRO (Momentary)
Intro End Reset Pulse from R.F.G. via IC24B
D
S
Q
R
Q̄
C
100K
D26
Q2
INTRO & DOWNBEAT LAMP DRIVER
INTRO LAMP ENABLE
IC22A
10K
D19
100K
.33
From Downbeat Detector Q3 (Pos. Pulse at Downbeat)
D20
To R.F.G. Pin 13
To R.F.G. Pin 14
D21
AND
INVERTER
A
B
C

D FLIP-FLOP

Tn				Tn+1	
D	S	R	Clk	Q	Q̄
0	0	0	↑	0	1
1	0	0	↑	1	0
X	0	0	↓	Qn	Q̄n
X	0	1	X	0	1
X	1	0	X	1	0
X	1	1	X	1	1

INVERTER

A	B
1	0
0	1

AND

A	B	C
0	0	0
1	0	0
0	1	0
1	1	1

Fig. 5 - Intro Lamp Enable

Preset Intro Lamp Enable
[See Fig. 5]

Before starting a rhythm (Rhythm tabs off or Auto Start enabled), the Intro may be preset as follows:

1) The output of Rhythm Playing Detector IC28A Pin 3 will be low (because either a rhythm tab has not been pressed or the Auto Start is enabled but the rhythm has not been started).
2) The low output of IC28A is inverted to a high and applied to Preset Intro Lamp Enable IC22B Pin 6.
3) Pressing the Intro button applies positive voltage to Pins 13 and 14 of the RFG, enabling the RFG to output the Intro pattern. Positive voltage is applied to IC22B Pin 5 causing its output to switch high (because Pin 6 is also high). This high is applied to the Set input of Intro Lamp Driver Latch IC23B.
4) The high applied to the Set input of Intro Lamp Driver Latch IC23B causes the Q output to switch high.
5) The high outputted by IC23B Pin 13 causes Intro and Downbeat Lamp Driver transistor Q2 to saturate lighting the lamp.

Starting the rhythm causes the intro to play. At the conclusion of the intro sequence, the intro lamp is turned off as follows:

1) When the rhythm was started, both inputs to Rhythm Playing Detector IC28A switched high. The high outputted from IC28A is inverted to a low and applied to the Set input of IC23B Intro Lamp Driver Latch.
2) At the conclusion of the Intro, the RFG Pin 19 outputs a positive pulse. This pulse is applied to the reset input of IC23B which causes its Q output to switch low, causing Intro and Downbeat Lamp Driver Q2 to cut off which turns off the lamp.

Rhythm Playing Intro Lamp Enable
[See Fig. 5]

If the Intro button is pressed while a rhythm is playing, the following sequence occurs:

1) Initially, the Q output of IC23B is low (Q-bar high) so the Intro lamp is off.
2) When the Intro button is pressed, the RFG resets and outputs a pulse at Pin 26 which causes Downbeat Detector Q3 to output a positive pulse.
3) The reset pulse is applied to one input of Intro Lamp Enable IC22A. The other input to IC22A is the Q-bar output of IC23B which at this time is high. Because both inputs to IC22A are high, its output switches high and clocks Intro Lamp Driver Latch IC23B.
4) The data input to IC23B is high (because the Intro button is pressed). This high is clocked to the Q output of IC23B which causes Intro and Downbeat Lamp Driver Q2 to saturate, lighting the lamp.

INSTRUMENTATION

The Instrumentation circuits produce the instrument voices for the rhythm. The generator outputs are applied to the rhythm preamp where the voices are amplified and sent via the rhythm volume control to the output preamp.

IC1, IC2, IC3, IC4C RHYTHM GENERATORS

The Rhythm Generators are tuned resonant circuits. Positive pulses from the Rhythm Function Generator cause the circuits to generate short bursts of audio oscillation with diminishing amplitudes. The outputs of the Rhythm Generators are combined and applied to the Left and Right Channel Drum Amps IC4B and IC4D.

IC10 NOISE GENERATOR

The Noise Generator produces a random noise signal. When the Snare, Brush or Cymbal Keyer circuits operate, this signal is passed through D47 and D45, 46 or 48 to the Cymbal, Snare or Brush Voicing circuits.

CIRCUIT DESCRIPTION

Q17, Q18, Q19 SNARE KEYER, SNARE VOICING

Positive pulses from Pin 5 of IC27 are applied to the High Drum and Low Drum generators causing them to oscillate producing the High and Low Drum voices. These audio signals are then combined and routed to the Left and Right Channel Amps. Pin 5 also applies a positive pulse to the base of Q17, Snare Keyer, turning it on. This causes positive voltage to turn on Diodes D48 and D47 which allow noise signal to pass to the Snare Voicing circuit Q18 and Q19 where it is voiced for proper tonality. The voiced noise signal at the output of Q19 combines with the High and Low Drum signals, together creating the Snare Drum voice.

NOTE: When the Rhythm 3 tab is pressed, the Low Drum generator is disabled and the Rim Shot generator is enabled giving a rim shot effect to the Swing, Bosa Nova and Soft Rock rhythm patterns.

Q9-12 CYMBAL KEYER, CYMBAL VOICING

Positive pulses from Pin 21 of IC27 are applied to the base of Q10, Cymbal Keyer, turning it on. This applies positive voltage to Diodes D45 and D47 which now conducts allowing noise signal to pass to the Cymbal Voicing circuit. Here the signal is voiced for proper Cymbal tonality then applied to the Left and Right Channel Brush Amps. With each positive pulse applied to Q10 a .27uf capacitor is charged. The length of the Cymbal tone is regulated by varying the discharge time of this capacitor. Depending on the rhythm selected, positive pulses are outputted from ROM 2 (see Schematic 12) which causes Cymbal Snub Switcher Q9 to saturate. This connects a resistor to ground which regulates the discharge rate of the .27uf capacitor, thereby regulating the length of the cymbal tone.

Q13-16 BRUSH KEYER, BRUSH VOICING

Positive pulses from Pin 22 of IC27 are applied to the base of Q14, Brush Keyer, turning it on. This applies positive voltage to Diodes D46 and D47 which now conduct allowing noise signal to pass to the Brush Voicing circuit. Here the signal is voiced for proper Brush tonality then applied to the Left and Right Channel Brush Amps. With each positive pulse applied to Q14, a .27uf capacitor is charged. The length of the Brush tone is regulated by varying the discharge time of this capacitor. Depending on the rhythm selected, positive pulses are outputted from ROM 2 (see Schematic 12) which causes Brush Snub Switcher Q13 to saturate. This connects a resistor to ground which regulates the discharge rate of the .27uf capacitor, thereby regulating the length of the brush tone.

IC4B, IC4D, IC5B, IC5C LEFT AND RIGHT CHANNEL DRUM AND BRUSH AMPS

Audio signals created by the Instrumentation circuits are applied to the Drum and Brush Amps where the signal is amplified before being applied to the Left and Right Channel Mixers.

IC4A RIGHT CHANNEL MIXER

The right channel drum and brush signals are balanced and applied to Right Channel Mixer IC4A where the signal is amplified before being applied to the Output Mixer via the Rhythm Volume Control.

IC5A LEFT CHANNEL MIXER

The left channel drum and brush signals are balanced and applied to Left Channel Mixer IC5A where the signal is amplified before being applied to the Output Mixer via the Rhythm Volume Control.

Q8 GENIE MODULATOR DRIVER

Positive voltage pulses from Pin 23 of IC27 are applied to the base of Genie Modulator Driver Q8 causing it to turn on. This applies positive voltage pulses to Lower Keyboard Modulator Pin 5 (see Schematic 8) gating the Lower Keyboard signal through the Lower Keyboard Modulator in a pattern determined by the rhythm selected. Pin 24 of IC27 is normally low. In this condition the Lower Keyboard audio has a staccato sound. For certain rhythm time points, Pin 24 goes positive, removing the discharge path for the .22uf capacitor at the base of Q8. This gives a sustain to the modulated audio. If no rhythm tabs are pressed, a steady positive voltage is applied from Inverter IC25A through D24 to the base of Q8. This holds the Lower Keyboard Modulator on and allows the Lower Keyboard signal to pass unmodulated.

SCHEMATIC 12

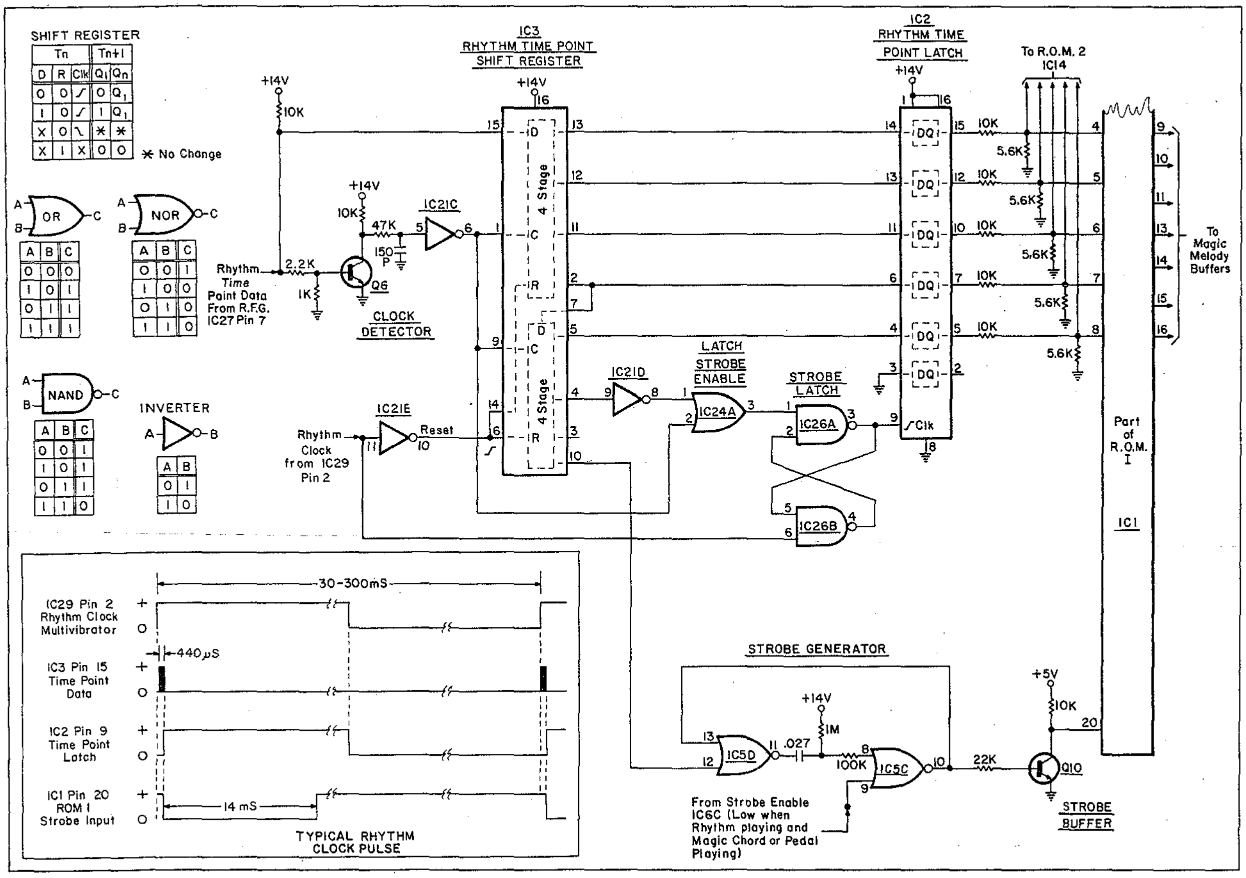
MAGIC MELODY & SWING BASS LOGIC

OVERVIEW

The Magic Melody and Swing Bass Logic circuits can be divided into two sections, keying and audio.

The keying section consists of two read only memories (ROM). A ten bit address (combination of ten high/low inputs) is applied to each ROM input. This address has information pertaining to the rhythm track and tab selected and the active rhythm time point. Each rhythm time point causes the outputs of the ROM to change which triggers the Magic Melody and Swing Bass notes.

CIRCUIT DESCRIPTION



SHIFT REGISTER
Tn
Tn+1
D R Clk Q1 Qn
* No Change
OR
NOR
NAND
INVERTER
Rhythm Time Point Data From R.F.G. IC27 Pin 7
Rhythm Clock from IC29 Pin 2
+14V
10K
47K
2.2K
1K
150
Q6
IC2IC
CLOCK DETECTOR
IC2IE
Reset
IC3
RHYTHM TIME POINT SHIFT REGISTER
4 Stage
IC21D
LATCH STROBE ENABLE
IC24A
STROBE LATCH
IC26A
IC26B
IC2
RHYTHM TIME POINT LATCH
DQ
Clk
To R.O.M. 2 IC14
5.6K
To Magic Melody Buffers
Part of R.O.M. I
IC1
STROBE GENERATOR
IC5D
IC5C
.027
1M
100K
22K
+5V
Q10
STROBE BUFFER
From Strobe Enable IC6C (Low when Rhythm playing and Magic Chord or Pedal Playing)
30-300mS
IC29 Pin 2 Rhythm Clock Multivibrator
440μS
IC3 Pin 15 Time Point Data
IC2 Pin 9 Time Point Latch
IC1 Pin 20 ROM I Strobe Input
14 mS
TYPICAL RHYTHM CLOCK PULSE

Fig. 6 - Rhythm Time Point Data Decoding

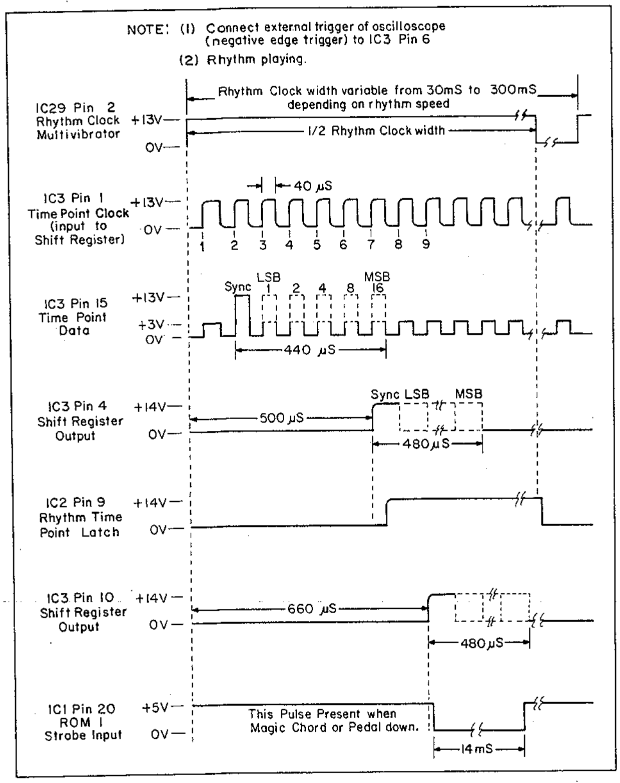
The audio section consists of a phase-locked loop (PLL) which generates a high frequency signal when an audio frequency (from the Chord Function Generator or bass pedal) is applied to its input. The high frequency is applied to an Octave Synthesizer which generates thirteen audio frequencies. The harmonically related frequencies (Root, third, fifth, sixth and minor seventh) are applied to the Magic Melody Keying Circuits (see Schematic 13). Positive pulses from Read Only Memory 1 (ROM 1) key the audio. The keyed audio is applied to Magic Melody filters where the tonality is developed. The root, second, third, fifth, sixth, seventh and eighth (octave) frequencies are inputted to the Swing Bass Note Select. A three bit note select from ROM 2 selects a bass frequency that will be applied to the Swing Bass circuit.

DEVELOPMENT OF TEN BIT ADDRESS

A ten bit address (combination of ten high/low inputs) is applied to Read Only Memories (ROM) 1 and 2. The two most significant bits (MSB) contain the track select information (Track A, B or C). The next three bits show which of the six rhythm tabs (or Intro) is pressed. The five least significant bits (LSB) show the active time point of the rhythm pattern.

Track Select Decoding
[Two Most Significant Bits]
XX 000 00000

The two most significant bits applied to the ROM identify the track selected. Selecting Track A applies a high (+14 volts) to ROM 1 and ROM 2 Pins 22. A high is applied to ROM 1 and ROM 2 Pins 23 when Track B is selected. Pins 22 and 23 will both be low (zero volts) when Track C is selected.



NOTE: (1) Connect external trigger of oscilloscope (negative edge trigger) to IC3 Pin 6
(2) Rhythm playing.

IC29 Pin 2 Rhythm Clock Multivibrator
+13V
0V
Rhythm Clock width variable from 30mS to 300mS depending on rhythm speed
1/2 Rhythm Clock width
IC3 Pin 1 Time Point Clock (input to Shift Register)
+13V
0V
40 μS
1 2 3 4 5 6 7 8 9
IC3 Pin 15 Time Point Data
+13V
+3V
0V
Sync
LSB 1
2
4
8
MSB 16
440 μS
IC3 Pin 4 Shift Register Output
+14V
0V
500 μS
Sync LSB MSB
480 μS
IC2 Pin 9 Rhythm Time Point Latch
+14V
0V
IC3 Pin 10 Shift Register Output
+14V
0V
660 μS
480 μS
IC1 Pin 20 ROM 1 Strobe Input
+5V
0V
This Pulse Present when Magic Chord or Pedal down.
14 mS

Fig. 7 - Expanded Rhythm Data Timing Diagram

Rhythm Select Decoding
OO XXX OOOOO

A priority encoder IC15 is used to develop the rhythm tab data. The Intro pattern has the highest priority followed by the rhythm 6 tab. The lowest priority is assigned to the rhythm 1 tab. The input with the highest priority will have a three bit output which is applied to Pins 1, 2 and 3 of ROM 1 and ROM2.

Rhythm Time Point Data Decoding
[Five Least Significant Bits]
OO OOO XXXXX
[See Fig. 6]

The Rhythm Function Generator (RFG) contains an internal oscillator which oscillates at a frequency of 12.5KHz. The time point clock frequency is outputted from the RFG at Pin 7. The output at Pin 7 has three logic levels (see Fig.7 - IC3 Pin 15 Time Point Data). The half level output is the 12.5KHz oscillator. The high level output is a sync pulse and when the rhythm is running, the five pulses folowing the sync pulse contain binary encoded rhythm time point data.

The time point clock (TPC) frequency outputted from Pin 7 of the RFG is applied to the Clock Detector Q6. The Clock Detector saturates and cuts off which amplifies the TPC frequency. Inverter IC21C inverts the TPC frequency and applies the clock pulses to the Rhythm Time Point Shift Register IC3 and the Latch Strobe Enable IC24A. (See Fig. 7 IC3 Pin 1 - Time Point Clock.)

Rhythm time point data is applied to Pin 15 of IC3 (see Fig. 7 - IC3 Pin 15 Time Point Data) when the rhythm is running. The input of IC3 (Pin 3) does not 'see' the half level TPC frequency because the clock pulse amplitude is below the threshold of IC3. Therefore, only data corresponding to the active time point will be clocked into the shift register.
NOTE: The following sequence is completed less than .5 milliseconds after the Rhythm Clock output switches positive. [See Diagram Fig. 6.]

Each time the Rhythm Clock output switches positive, a low is applied (from Inverter IC21E) to the reset input of IC3 enabling IC3. The time point data is clocked into the shift register IC3.

Normally, the output of Inverter IC21D is high. When the sync pulse is shifted to Pin 4 of IC3, the output of IC21D switches low. This low is applied to one input of Latch Strobe Enable IC24A. When the time point clock frequency switches low, the output of IC24A switches low. This toggles Strobe Latch IC26A Pin 3 high, clocking Rhythm Time Point Latch IC2. This latches the time point data into IC2. The least significant bit (LSB) is applied to IC2 Pin 4 and the most significant bit (MSB) is applied to IC2 Pin 14. Once transferred to the Q outputs of IC2, the time point data is applied to Read Only Memories (ROM) 1 and 2 where it becomes part of the ten bit address.

Magic Melody and Swing Bass Keying

The time point data continues to shift through the Rhythm Time Point Shift Register IC3. When the sync pulse shifts to Pin 10 of IC3, a pulse is triggered in the Strobe Generator. If the rhythm is playing and a Magic Chord or Pedal is being played, a positive pulse is outputted from IC5C Pin 10. The positive pulse causes the Strobe Buffer Q10 to saturate. The collector of Q10 switches low which enables ROM 1. When enabled, ROM 1 outputs (in parallel) the eight bit binary word corresponding to the address code applied to the input pins. If an output level is high, a keying pulse is applied through the Magic Melody Buffers Q16-29 to the Magic Melody Keying Circuits or through Swing Bass Keyer Buffer IC8D to the Swing Bass Keyer IC7D.

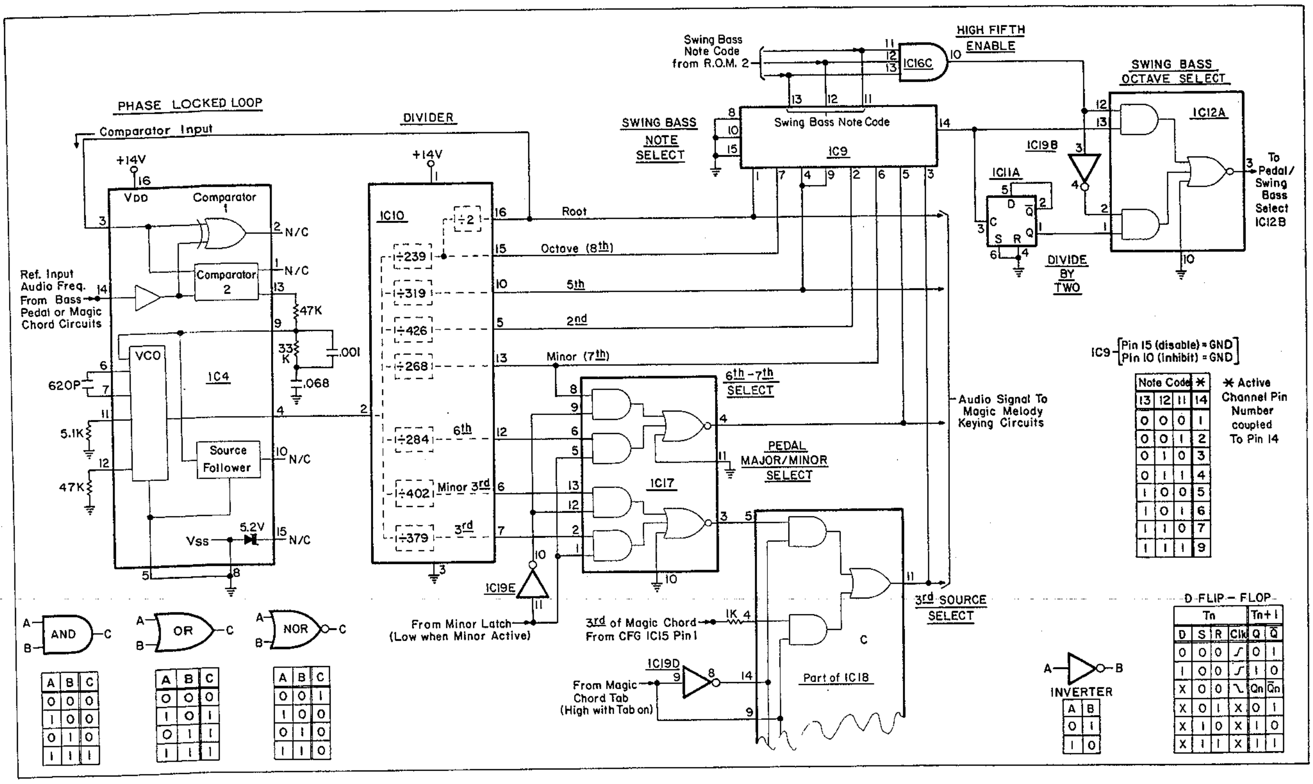

PHASE LOCKED LOOP
Comparator Input
+14V
VDD
Comparator 1
N/C
Ref. Input Audio Freq. From Bass Pedal or Magic Chord Circuits
Comparator 2
47K
33K
.001
.068
VCO
IC4
620P
5.1K
47K
Source Follower
5.2V
Vss
DIVIDER
+14V
IC10
÷2
÷239
÷319
÷426
÷268
÷284
÷402
÷379
Root
Octave (8th)
5th
2nd
Minor (7th)
6th
Minor 3rd
3rd
IC19E
From Minor Latch (Low when Minor Active)
Swing Bass Note Code from R.O.M. 2
IC16C
HIGH FIFTH ENABLE
SWING BASS NOTE SELECT
Swing Bass Note Code
IC9
6th - 7th SELECT
IC17
PEDAL MAJOR/MINOR SELECT
3rd of Magic Chord From CFG IC15 Pin 1
1K
IC19D
From Magic Chord Tab (High with Tab on)
Part of IC18
C
3rd SOURCE SELECT
Audio Signal To Magic Melody Keying Circuits
IC11A
D Q̄ C S R Q
DIVIDE BY TWO
IC19B
SWING BASS OCTAVE SELECT
IC12A
To Pedal/Swing Bass Select IC12B
IC9 [Pin 15 (disable) = GND / Pin 10 (inhibit) = GND]
Note Code 13 12 11 | ✱ 14
0 0 0 | 1
0 0 1 | 2
0 1 0 | 3
0 1 1 | 4
1 0 0 | 5
1 0 1 | 6
1 1 0 | 7
1 1 1 | 9
✱ Active Channel Pin Number coupled To Pin 14
AND: A B C — 0 0 0 / 1 0 0 / 0 1 0 / 1 1 1
OR: A B C — 0 0 0 / 1 0 1 / 0 1 1 / 1 1 1
NOR: A B C — 0 0 1 / 1 0 0 / 0 1 0 / 1 1 0
INVERTER: A B — 0 1 / 1 0
D-FLIP-FLOP: Tn (D S R Clk) | Tn+1 (Q Q̄)
0 0 0 ↑ | 0 1
1 0 0 ↑ | 1 0
X 0 0 ↓ | Qn Q̄n
X 0 1 X | 0 1
X 1 0 X | 1 0
X 1 1 X | 1 1

Fig. 8 - Magic Melody and Swing Bass Audio Frequency Generator

ROM 2 is enabled at all times (because Pin 20 is connected to ground). Each time the time point data changes, the outputs change. ROM 2 has information which selects the snubs for the cymbal and brush rhythm instruments and the Magic Melody Piano. The lower keyboard accent is also controlled by ROM 2. Three outputs of ROM 2 (Pins 9, 10 and 11) are decoded by Swing Bass Note Select IC9 to select the pitch of the Swing Bass Note that will be heard.

Q16-29 MAGIC MELODY BUFFERS

Seven of the eight outputs of ROM 1 are connected to the Magic Melody Buffer circuits. Each time an output of ROM 1 is active, it goes positive which causes the transistor (Q16-22) connected to its output to saturate. When this transistor (Q16-22) saturates, it causes the PNP transistor (Q23-29) to saturate applying positive voltage to its corresponding Magic Melody Keying circuit. (See Schematic 13.)

AUDIO

The Magic Melody and Swing Bass tone generator consists of a phase-locked loop and an octave frequency divider. The audio frequencies outputted by the divider are applied to the Magic Melody Keyers and to the Swing Bass Note Select.

IC4 PHASE-LOCKED LOOP [See Fig. 8.]

The reference input to the Phase-Locked Loop (Pin 14) is an audio frequency from either the Pedal Latch or Chord Function Generator. The reference frequency is the root of the chord to be outputted by the Magic Melody and Swing Bass circuits.

The primary components of the phase-locked loop are a comparator and a voltage controlled oscillator (VCO). One input to the comparator is the reference frequency. The other comparator input (Pin 3) is the root pitch of the Octave Frequency Divider IC10. When the frequency at Pin 3 is not equal to the reference frequency, comparator 2 outputs a voltage which changes the frequency of the VCO until it generates a frequency which makes the frequency and phase of the signal at Pin 3 the same as the reference at Pin 14.

IC10 DIVIDER [See Fig. 8]

The Divider, IC10, is an octave frequency synthesizer. When a reference frequency is applied to the phase-locked loop, the Divider generates the same frequency (root) and the twelve notes above it. These audio frequencies are applied to the Magic Melody keyers and to the Swing Bass Note Select IC9. When the rhythm is running, keying voltage from Read Only Memory (ROM) 1 selects the Magic Melody notes that will be heard. ROM2 outputs a three bit code that selects the Swing Bass note that will be keyed.

NOTE: When there is no reference frequency input to the PLL, the VCO outputs a low frequency.

IC17 6TH - 7TH SELECT [See Fig. 8]

Normally, Pin 5 of IC17 is high. This enables the sixth of the octave to be outputted. When the Minor Footswitch is pressed, Pin 5 is applied low and Pin 9 is applied high. This enables the minor seventh of the octave to be outputted. Therefore, Magic Melody and Swing Bass patterns that key the sixth of an octave, will key the minor seventh when the minor footswitch is pressed.

IC17 PEDAL MAJOR/MINOR SELECT. [See Fig.8]

Normally, Pin 1 of IC17 is high. This enables the third of the octave to be outputted. When the Minor Footswitch is pressed, Pin 1 is applied low and Pin 12 is applied high. This enables the minor third of the octave to be outputted. The third or minor third pitch is applied to Pin 5 of Third Source Select, IC18.

IC18C THIRD SOURCE SELECT [See Fig. 8]

When the Magic Chord tab is off, Pin 14 of IC18 is high enabling the signal at Pin 5 of IC18 (from IC17 Pin 3) to pass through IC18 to Pin 11. Turning on the Magic Chord tab applies a low to Pin 14 and a high to Pin 9 enabling the third/minor third output of the CFG to pass to the output of IC18.

IC9 SWING BASS NOTE SELECT [See Fig. 8]

The Swing Bass Note Select IC9 is an eight channel data selector. A three bit code is applied to Pins 11, 12 and 13 from ROM 2. The code selects the pitch that will be outputted from IC9. (See Truth Table Fig. 8). The selected note is applied to a divider and to Swing Bass Octave Select IC12A.

IC11A DIVIDE-BY-TWO DIVIDER [See Fig. 8]

The selected Swing Bass note is applied to IC11A where the audio frequency is divided in half. The divided swing bass audio is applied to Swing Bass Octave Select IC12A.

IC12A, IC16C SWING BASS OCTAVE SELECT, HIGH FIFTH ENABLE [See Fig. 8]

Normally, Pin 12 of IC12A is low and Pin 2 is high. This enables the divided Swing Bass audio to pass through IC12A. When the three bits of the Swing Bass Note code are high (all ones), the fifth note of the octave is selected. The three inputs to High Fifth Enable IC16C will be high and its output will switch high. This high is applied to Pin 12 of IC12A and inverted to a low through IC19B and applied to Pin 2. This enables the fifth of the octave to pass through IC12A without being divided. The signal output of IC12A is applied to Pedal/Swing Bass Select IC12B.

IC12B, IC11B PEDAL/SWING BASS SELECT, DIVIDER

When the Swing Bass Tab is off, Pin 8 of IC12B is low and Pin 5 is high (through Inverter IC19C). This enables the pedal bass audio to be applied to Divider IC11B. When the Swing Bass is enabled, Pin 8 will be high and Pin 5 will be low (through Inverter IC19C). This enables the Swing Bass audio to pass to Divider IC11B. The audio outputted by IC11B is applied to the 8-foot Pedal Divider IC9B (see Schematic 14).

IC19C, Q11 PEDAL SUSTAIN, SWING BASS SNUB SWITCHER

Pin 6 of IC19C is high when the Swing Bass tab is off. Pressing the Pedal Sustain tab applies this voltage through D1 to the cathode of D34 (see Schematic 14). This reverse biases D34 which, in effect, opens the discharge path for the pedal sustain capacitor. The capacitor discharges onto the base of Swing Bass/Pedal Driver transistor Q25 creating a sustain effect.

Enabling the Swing Bass applies a high to the input of IC19C which switches its output low disabling pedal sustain. The high level is applied through a 22K resistor to both the Swing Bass Snub Switcher Q11 and through Diode D2 to Swing Bass/Pedal Driver Q25 (see Schematic 14). When ROM 2 outputs a positive pulse at Pin 13, Q11 saturates which grounds the voltage applied to Q25. This permits the sustain capacitor to discharge through D34 which gives staccato to the Swing Bass.

IC18A PHASE-LOCKED LOOP REFERENCE SELECT

This section of IC18 selects audio from either the pedal bass (IC10 Pin 4) or Chord Function Generator (IC15 Pin 40). This permits the Magic Melody and Swing Bass to be keyed from the bass pedals or from the Magic Chord keys when the Magic Chord tab is on.

Q13-15 GENIE KEYDOWN DETECTOR

Each time a Magic Chord Key is pressed, positive voltage is applied to the emitter of Q13. The emitter of Q13 becomes more positive than the base and Q13 cuts off. When Q13 cuts off, a positive pulse is developed across a .01uf capacitor which causes Q14 to momentarily saturate. Transistor Q15 cuts off and applies a positive pulse to Latch Reset Source Select IC18B.

IC18B LATCH RESET SOURCE SELECT

This section of IC18 selects the source of reset pulses to be applied to the Minor Latch IC5A&B. A pulse from the Pedal Latch IC5 is inverted by IC25C and applied through IC18B to the Minor Latch unless the Magic Chord tab is on. When the Magic Chord tab is on, reset pulses are applied from the Genie Keydown Detector through IC18B to the Minor Latch.

IC5A&B MINOR LATCH

The Minor Latch is a set/reset flip-flop. When the Minor footswitch is pressed, positive voltage is applied to Pin 1 of IC5A. Its output Pin 3 switches low. The low disables the third and sixth outputs of the octave synthesizer Divider IC10. The low is inverted by IC19E and enables the minor third and minor seventh outputs of IC10. When a new pedal or Magic Chord Keyswitch is pressed, a pulse is applied to Pin 6 of IC5B which resets Pin 3 high.

IC16A RHYTHM & MAGIC CHORD 'ON' DETECTOR

All three inputs to IC16A must be high before Pin 9 (output) will switch high. Pin 9 will be high only when a rhythm is playing and the Magic Chord tab is off. This enables the Pedal Down Latch IC26C&D.

IC26C&D PEDAL DOWN LATCH

When a bass pedal is pressed, a low is applied to IC26C Pin 8 switching its output Pin 10 high. Pin 12 goes high because Pin 10 is high. When Pin 13 (enable) is high, the output of IC26D switches low. This low is applied back to IC26C Pin 9 latching Pin 11 low. This low level is applied to one input of Chord/Pedal Down Detector IC13A. IC26D Pin 11 will be reset high when the rhythm is not playing or the Magic Chord tab is pressed. Pin 11 is reset high at power turn on.

IC13A CHORD/PEDAL DOWN DETECTOR

The output of the Pedal Down Latch is applied to Pin 1 of IC13A. Pin 1 will be low when the following conditions are met:

1) The Magic Chord tab is off
2) The Rhythm is running
3) A bass pedal is pressed.

The input to Pin 2 of IC13A is from the Chord Function Generator Pin 3. When the Magic Chord tab is off, IC13A Pin 2 will be high. When the Magic Chord tab is on and a Magic Chord is being played, the CFG Pin 3 outputs an audio signal. Diode D5 and the .022 uf capacitor rectify the audio into a low level.

When one of the inputs to IC13A is low, its output Pin 3 switches low. This is applied to Strobe Enable IC6C.

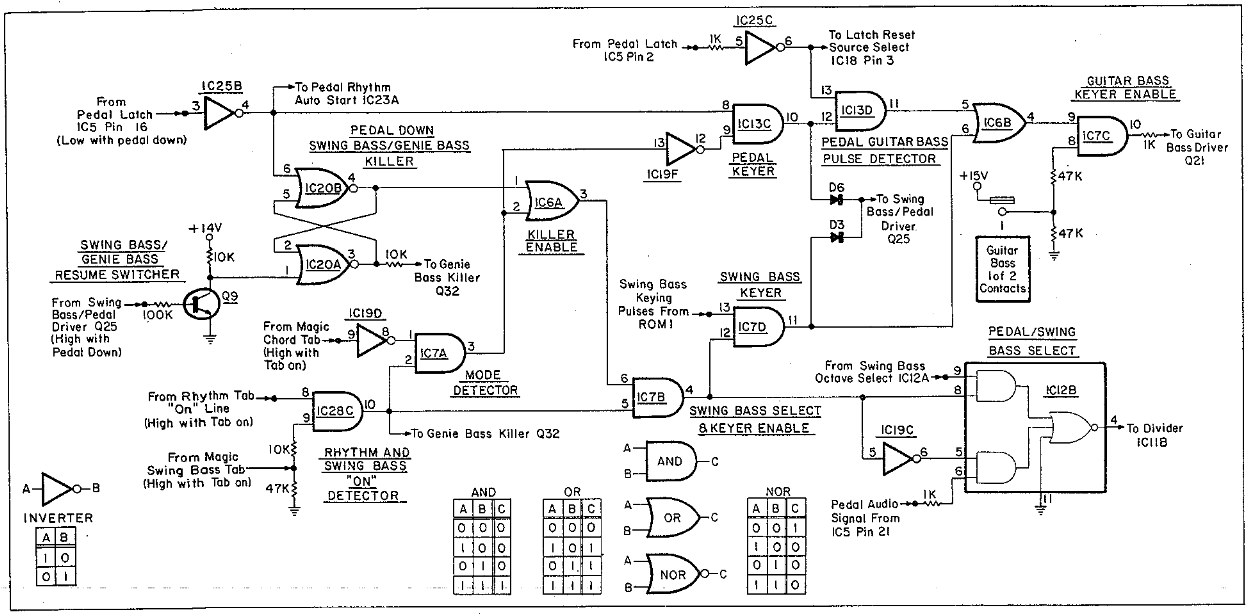
IC6C STROBE ENABLE

The Strobe Generator is enabled when Pin 9 of IC5C is low. Pin 9 will be low when the rhythm is playing and either a bass pedal or Magic Chord is played.

Genie Bass Killer
[See Fig. 9]

Q9, IC20A&B SWING BASS/GENIE BASS RESUME SWITCHER, KILLER

The lower keyboard Swing and Magic Genie bass are cancelled when a bass pedal is pressed. IC20A&B forms a Set/Reset Flip-Flop. Pin 1 of IC20A is normally high which keeps Pin 3 reset low. When a bass pedal is pressed, positive voltage is applied to Q9 causing it to saturate and switch Pin 1 low. The output of the Pedal Latch is inverted to a high by IC25B and applied to Pin 6 of IC20B. This "sets" Pin 3 of IC20A high. This positive voltage is applied to the Genie Bass Killer Q32 (see Schematic 14) grounding the Genie Bass keying voltage. Releasing the bass pedal removes the voltage from the base of Q9. Q9 cuts off applying a high to IC20A Pin 1 resetting Pin 3 low.


IC25C
From Pedal Latch IC5 Pin 2
1K
To Latch Reset Source Select IC18 Pin 3
IC25B
From Pedal Latch IC5 Pin 16 (Low with pedal down)
To Pedal Rhythm Auto Start IC23A
PEDAL DOWN SWING BASS/GENIE BASS KILLER
IC20B
IC13C
IC13D
IC19F
PEDAL KEYER
PEDAL GUITAR BASS PULSE DETECTOR
IC6B
IC7C
GUITAR BASS KEYER ENABLE
To Guitar Bass Driver Q21
+15V
47K
D6
To Swing Bass/Pedal Driver Q25
D3
Guitar Bass 1of 2 Contacts
IC6A
KILLER ENABLE
+14V
SWING BASS/ GENIE BASS RESUME SWITCHER
10K
IC20A
To Genie Bass Killer Q32
From Swing Bass/Pedal Driver Q25 (High with Pedal Down)
100K
Q9
Swing Bass Keying Pulses From ROM 1
SWING BASS KEYER
IC7D
IC19D
From Magic Chord Tab (High with Tab on)
IC7A
MODE DETECTOR
PEDAL/SWING BASS SELECT
From Swing Bass Octave Select IC12A
IC12B
To Divider IC11B
From Rhythm Tab "On" Line (High with Tab on)
IC28C
To Genie Bass Killer Q32
IC7B
SWING BASS SELECT & KEYER ENABLE
IC19C
From Magic Swing Bass Tab (High with Tab on)
10K
47K
RHYTHM AND SWING BASS "ON" DETECTOR
Pedal Audio Signal From IC5 Pin 21
1K
INVERTER
A B
AND
OR
NOR
C

A	B
1	0
0	1

A	B	C
0	0	0
1	0	0
0	1	0
1	1	1

A	B	C
0	0	0
1	0	1
0	1	1
1	1	1

A	B	C
0	0	1
1	0	0
0	1	0
1	1	0

Fig. 9 - Pedal/Swing Bass Keying Source Select

Swing Bass Killer
[See Fig. 9]

IC7A, IC6A MODE DETECTOR, KILLER ENABLE

When the Magic Chord tab is on, the output of Mode Detector IC7A Pin 3 will be low. When a bass pedal is pressed, Pin 4 of IC20B switches low. Because both inputs to Killer Enable IC6A are low, its output switches low which disables the Swing Bass Keyer IC7D (through IC7B) and switches Pedal/Swing Bass Select IC12B to the Pedal Bass position. When the bass pedal is released, IC20B Pin 4 is reset high enabling the Swing Bass to resume.

BASS PEDAL KEYING
[See Fig. 9]

Pressing a bass pedal applies a low to IC25B which inverts the low to a high level. This high level triggers the Rhythm Auto Start (if a rhythm tab and the Auto Start tab are pressed) and is applied to the Pedal Keyer IC13C Pin 8. If the Swing Bass tab is off, Pin 9 of IC13C is high and the voltage applied to Pin 8 is outputted at Pin 10 and applied to Swing Bass/Pedal Driver Q25 (see Schematic 14) keying the pedal bass audio.

Pedal Guitar Bass
[See Fig. 9]

The Pedal Latch outputs a pulse at pedal keydown which is inverted to a positive pulse by IC25C. This pulse is passed through IC13D Pedal Guitar Bass Pulse Detector and OR gate IC6B to Pin 9 of Guitar Bass Keyer Enable IC7C. When the Guitar Bass tab is on, the pulse is passed through IC7C and applied to Guitar Bass Driver Q21 (see Schematic 14).

SWING BASS KEYING
[See Fig. 9]

The Swing Bass may be keyed from either the bass pedals or lower keyboard depending on the position of the Magic Chord tab.

When a rhythm tab and the Magic Swing Bass tab are on, the output of Rhythm and Swing Bass "On" Detector IC28C will be high. This high level performs three functions.

1) It disables the Genie (keyboard) bass by causing Q32 to saturate (see Schematic 14).
2) It applies a high level to Mode Detector IC7A Pin 2. If the Magic Chord tab is off, Pin 1 of IC7A will be high and the output, Pin 3, of IC7A will go high. This high is applied through Killer Enable IC6A to Pin 6 of Swing Bass Select and Keyer Enable IC7B. This high also disables Pedal Keyer IC13C.
3) It applies a high to Pin 5 of IC7B. Because both inputs to IC7B are high, its output switches high and enables the Swing Bass Keyer IC7D and selects the Swing Bass Audio Input to Pedal/Swing Bass Select IC12B.

When the above conditions are met, pulses from Read Only Memory 1 Pin 17 are applied through IC7D Swing Bass Keyer to Swing Bass/Pedal Driver Q25 (see Schematic 14). When the Guitar Bass tab is on, Swing Bass Keyer Pulses are passed through IC7C Guitar Bass Keyer Enable and applied to the Guitar Bass Driver Q21. (See Schematic 14.)

SCHEMATIC 13
MAGIC MELODY KEYING AND FILTERING

IC7, IC8 MAGIC MELODY DIVIDERS

The audio frequencies outputted by the Octave Synthesizer Divider IC10 are applied to the cathodes of keying diodes (D18, D21 and D3) and the clock inputs of dividers IC7A, 7B, 8A and 8B where the frequency is divided in half and applied to the cathodes of keying diodes D12, D15, D6 and D9). When the rhythm is running and Read Only Memory 1 is enabled (see Schematic 12), positive pulses are applied to the anodes of the keying diodes in a sequence determined by the selected rhythm to key the Magic Melody notes. The divided-by-two pitches are referred to as low octave Magic Melody notes.

Q20 PIANO SNUB SWITCHER

Positive pulses outputted by ROM 2 at various time points cause Q20 to saturate. This provides a discharge path for the 2.2uf sustain capacitors located on each keying line creating a staccato effect for the Magic Melody Piano voice at certain time points (see Rhythm Timing Diagrams).

IC6A Q7 MAGIC MELODY MIXER, PIANO FILTER

The keyed Magic Melody audio signals are applied to the Magic Melody Mixer before being routed to the Piano Filter. The Piano Filter develops the tonality of the Magic Melody Piano voice. The output of the Piano Filter is applied to the Magic Melody Piano Preamp via the Piano Switcher.

Q8 PIANO SWITCHER

The FET switcher is pinched off when the voltage at the gate is less positive than the voltage at the drain and source. When the Magic Melody Piano tab is turned on, positive voltage is applied to the gate of Q8 causing the switcher to turn on and pass the audio signal to the Magic Melody Piano Preamp.

IC6D MAGIC MELODY PIANO PREAMP

The Magic Melody piano audio signals are amplified by IC6D before being routed to the output mixer.

SCHEMATIC 14
BASS FILTERING

IC9B, IC9A DIVIDERS

The Pedal Bass or Swing Bass audio signals are applied to Divider IC9B where the frequency is divided to an eight foot pitch. IC9A divides the eight foot audio to a sixteen foot pitch.

Q25 SWING BASS/PEDAL DRIVER

Keying voltage from either the Bass Pedals or Swing Bass circuits (see Schematic 12) is applied to the base of Driver Q25 causing this transistor to saturate. When Q25 saturates it applies keying voltage to D36 and 16 foot Pedal Keyer Q24 and to D35 and 8 foot Pedal & Swing Bass Keyer Q26. Diode D34 is part of the sustain circuit for Q25. When D34 is reverse biased, the .1uf capacitor will discharge onto the base of Q25 when the bass pedal is released (or after the Swing Bass keying pulse). If there is no voltage present at the cathode of D34 and the keying voltage is removed from the base of Q25, then the .1uf sustain capacitor will discharge through D34 and the 1 Megohm resistor giving no sustain. When Q25 cuts off (after pedal release and sustain capacitor discharge) the Resume Switcher Q9 (see Schematic 12) cuts off enabling the keyboard bass.

Q24 16-FOOT PEDAL KEYER

When the Pedal 16'-8' tab is on (and the Magic Swing Bass tab is off), the reset input to IC9A 16' Pedal Divider is switched low enabling the divider to output 16' Pedal audio. Positive keying voltage from Q25 forward biases diode D36 applying 16-foot audio to Keyer Q24. The signal outputted at the emitter of Q24 is applied to the 8/16-foot Filter.

NOTE: If the Pedal 16-8 tab is on and the Magic Swing Bass tab is turned on, IC9A is disabled.

Q26 8-FOOT PEDAL AND SWING BASS KEYER

Positive keying voltage from Q25 forward biases diode D35 applying 8-foot audio to Keyer Q26. The signal outputted at the emitter of Q26 is applied to the 8/16-foot Filter and the Guitar Bass Filter.

Q21, Q22 GUITAR BASS DRIVER, KEYER

When the Guitar Bass tab is on, positive pulses from the Swing Bass Keyer or Pedal Guitar Bass Pulse Detector (see Schematic 12) are applied to the bass of Guitar Bass Driver Q21. When Q21 turns on, it applies a positive pulse to Guitar Bass Keyer Q22, turning it on. Applied to the base of Q22 is 8' bass audio. When Q22 turns on, the 8' bass audio is applied as a pulse to the Guitar Bass Filter.

Q29 GENIE BASS DRIVER

When the rhythm is playing, the Rhythm Function Generator outputs a sequence of pulses. These pulses are gated through a Pulse Detector IC9A and an Audio Detector IC9B (see Schematic 15) and applied to the base of Genie Bass Driver Q29. When Q29 turns on, it applies positive voltage to Genie Bass Keying Diode D33 and to the base of Genie Bass Keyer Q30. Diode D33 becomes forward biased which applies Genie Bass audio signal to Q30. The output of Q30 is applied to the Genie Bass Filter and to the Guitar Bass Filter when the Guitar Bass tab is on.

Q32 GENIE BASS KILLER

Genie Bass Killer Q32 is normally saturated which grounds the output of Genie Bass Driver Q29. When the Genie String Bass or Magic Swing Bass tabs are switched on, Q32 cuts off enabling Genie Bass Keyer Pulses to reach the Genie Bass Keyer Q30. When a Bass Pedal is pressed, positive voltage from Pedal Down Genie Bass Killer IC20 Pin 3 (see Schematic 12) saturates Q32 disabling the Genie Bass. If the Magic Swing Bass tab and a rhythm tab are on, Q32 will saturate disabling the Genie Bass.

Q36, Q31, Q23 16'/8', GENIE AND GUITAR BASS FILTERS

These active low-pass filters remove higher harmonics from the audio signal and develop the tonality for the 16- and 8-foot string bass and guitar bass voices.

Q27, Q28 BASS VOLUME SWITCHERS

When the Bass Volume tabs are off, Q27 and Q28 are saturated. A voltage divider is formed between the output coupling resistor of each filter and a 1.3K resistor to ground (through Q27). Resistors are added to the voltage divider when the Bass Medium or Bass Full tab is switched on, raising the junction at the input to the Bass Mixing Preamp higher above ground. This increases the signal level applied to the Bass Mixing Preamp, increasing the bass volume.

IC6B BASS MIXING PREAMP

The outputs of the 16'/8' Genie Bass and Guitar Bass Filters are mixed and amplified by IC6B. The output of IC6B is applied to the Output Mixer (see Schematic 10).

SCHEMATIC 15

CFG and PEDAL LATCH

Two major circuits are shown on Schematic 15. These are the Chord Function Generator (CFG) and the Pedal Latch. Both circuits share common components.

IC7 CFG/PEDAL OSCILLATOR

The CFG/Pedal Oscillator IC7 generates 500KHz which is applied directly to the Pedal Latch. The CFG/Pedal Oscillator frequency is divided in half (250KHz) and applied to the CFG. The CFG/Pedal Oscillator frequency is divided by eight (62.5KHz) and becomes the scan clock for the Magic Genie AOC Decoder.

NOTE: When the vibrato tab is on, the bass pedals and CFG features will have a vibrato effect. If a rhythm tab is turned on the output from the vibrato oscillator is grounded, cancelling vibrato of the Lower Keyboard Genie and pedal bass features.

MAGIC GENIE

IC15 CHORD FUNCTION GENERATOR

The Chord Function Generator IC15 contains a keyboard scanning system, five programmable frequency generators and the required logic to provide four output features which are bass, chord, strum and arpeggio.

CIRCUIT DESCRIPTION

NOTE: The strum, arpeggio and Boogie Woogie Bass keying functions of the CFG are not enabled and therefore not outputted from the CFG. The chord hold feature is latched in the on position. This enables the chord to continue to play after the Magic Chord key is released.

The 500KHz output of the CFG/Pedal Oscillator is divided-by-two by IC16B and applied to the CFG. This 250KHz signal is applied to five programmable frequency generators via Pin 24 of the CFG. The programmable generators are each capable of generating one of 12 frequencies, dependent on the address code provided them. These generators supply the audio signal for the Magic Chords, Strum and Arpeggio features in the chord mode of the CFG and the bass in both the chord and non-chord modes of the CFG.

The Magic Genie keyboard scanning system is capable of scanning 72 time points on a sequential basis. The scan matrix is partitioned in a 12 (X scan) by 6 (Y scan) array. Sequential pulses are outputted on the 12 'X' lines and a particular time point is active when one of the X lines is connected to one of the Y lines. The X scan outputs are normally high and go low when active.

In the non-chord mode (Magic Genie Chord tab off) the High/Low bass feature is the only function that is enabled. In this mode of operation, bass signal is outputted from Pins 6 and 7 of the CFG corresponding to the highest and lowest keyswitches (A1-C3) pressed.

In the chord mode (Magic Genie Chord tab on) circuitry is enabled to add data bits. These bits correspond to the notes in the chord being played. For example, if a chord is being played there will be data bits at 3 of the 72 time points (as observed at Pin 23). If the A2 Key (which is the 7th switch) is pressed, a fourth data bit is added to the chord; pressing the minor footswitch shifts the data at one of the time points creating the minor of the chord being played. The minor and 7th of the chord reset with each new keydown. The bass signal outputted at Pins 6 and 7 correspond to the fifth and root of the chord.

The root (Pin 40), third (Pin 1) and seventh (Pin 3) audio outputs are used to interface the CFG with the Magic Melody and Swing Bass Logic circuitry (see Schematic 12).

There are 28 Lower Keyboard Scan Keyswitches. The first twelve of these are Magic Chord keyswitches. Turning on the Magic Chord tabswitch performs five functions:

1) Pin 13 of IC25D Magic Chord Enable is switched high. This electrically disconnects Pin 29 from Pin 21 of the CFG which places the CFG in the chord mode of operation.
2) Pin 9 of IC12C Serial Data Enabler is switched high enabling serial data to be applied to the AOC Decoder.
3) Pin 2 of A2 Scan Disable IC25A is switched high which prevents keying the A2 scan keyswitch.
4) The A1-G#1 DC keyswitches are disabled by grounding these DC keyswitches through Q111 (see Schematic 3).
5) The Magic Melody and Swing Bass Logic circuitry is switched to the Magic Chord mode.

Pressing a Magic Chord keyswitch (A1-G#1) connects a Y scan line to an X scan line, causing data bits to appear at three CFG time points (four with seventh enabled). These data bits provide the address code for the programmable frequency generators, causing three (or four) audio frequencies that form a specific chord to be outputted at Pin 5 of the CFG. These audio signals are applied to the Magic Chord Preamp. The root (Pin 40) becomes the reference input to the Magic Melody and Swing Bass Phase-locked Loop. The third (Pin 1) becomes part of the Magic Melody and Swing Bass pattern. The seventh (Pin 3) is rectified into a DC voltage and used to enable ROM 1 (see Schematic 12). The Genie Bass Root and Fifth signals are outputted at Pins 7 and 6.

NOTES:

1) In the Magic Chord mode of operation, only the highest chord being played will sound.

2) All the features are outputted when a key is pressed. The chord hold function is enabled whenever the Magic Chord tab is on. This causes the chord data to latch and continue outputting the features after a Magic Chord key is released.

3) The 7th, Minor, Chord Hold, Magic Chord and Any Rhythm On features of the CFG are inverse functions. This means that the time points for these functions are active when the feature is not playing. To enable these functions to operate, the X and Y lines associated with them must be disconnected.

4) Diode D37 connects the X5 scan (CFG Pin 32) to the Y6 line (CFG Pin 21). This diode enables the audio outputs at Pins 1, 3 and 40 to have a 4' pitch. This four foot pitch provides the proper reference frequency to the Magic Melody and Swing Bass Phase-locked Loop.

IC25D MAGIC CHORD ENABLE

When Pin 13 of IC25D is low (Magic Genie Chord tab off), the X scan (Pin 29) is connected to the Y scan (Pin 21) disabling the Magic Chord function of the CFG. Placing the Magic Chord tab in the on position applies positive voltage to Pin 13 of IC25D. This holds Pin 11 (output) high. The Y scan line does not feel the negative transition of the X scan line from Pin 29. This places the CFG in the Magic Chord Mode of operation.

IC24D MINOR ENABLE

The low level at Pin 12 of IC24D connects the X10 scan line (CFG Pin 27) to the Y6 scan line (CFG Pin 21). When the Minor Footswitch (right side of the expression pedal) is momentarily pressed, a positive voltage holds Pin 12 of IC24D high. This momentarily disconnects the X and Y lines and causes the CFG to internally shift a chord data bit which corresponds to the minor of the chord being played. The minor chord will continue to play until either the same or a new Magic Chord key is pressed. The new chord will reset the function back to a major chord.

IC24C 7TH ENABLE

The X11 scan line (CFG Pin 26) is connected to the Y6 scan line through IC24C (due to the low at Pin 9 of IC24C). Momentarily pressing the lower keyboard A2 keyswitch applies a positive voltage to Pin 9 of IC24C. This disconnects the X and Y lines and causes the CFG to internally add a fourth data bit which adds the seventh note to the Magic Chord being played. The seventh chord will continue to play until either the same or a new Magic Chord key is pressed. The new chord will reset the function back to a major chord.

IC25C ANY RHYTHM ON GATE

The X6 scan line (CFG Pin 31) is connected to the Y6 scan line through IC25C (due to the low at Pin 8 of IC25C). When any rhythm tab is pressed, positive voltage is applied to Pin 8 of IC25C. This disconnects the X and Y lines which unlocks the internal bass multiplexer.

IC25B AUTO STOP CHORD HOLD DISABLE

The X9 scan line (CFG Pin 28) is disconnected from the Y6 scan line because Pin 6 of IC25B is high. When the rhythm is stopped (in the Auto position) Pin 6 of IC25B will be low, connecting the X and Y lines, disabling the Chord Hold feature.

Q1 MAGIC CHORD PREAMP

The chord signal outputted at Pin 5 of the CFG is applied through Chord Level Adjust VR1 to the base of Q1. This transistor amplifies the chord signal and applies it to the lower keyboard flute and string filters (see Schematics 5 and 6).

GENIE BASS

HIGH/LOW BASS

With the Magic Genie Chord tabswitch off, the only feature of the CFG chip that is outputted is the High/Low Bass. In this mode of operation, holding down two or more lower keyboard keyswitches (A1-C3) causes the following: audio signal corresponding to the highest note being played is outputted from Pin 6 of the CFG and audio signal corresponding to the lowest note being played is outputted from Pin 7 of the CFG. The high bass signal is routed to Pin 12 of the High/Low Bass Select IC10A and the Low bass signal is routed to Pin 2 of IC10A.

ROOT/FIFTH BASS

With the Magic Genie Chord tabswitch on, the bass feature of the chip is in the Root/Fifth mode of operation. If a Magic Genie Chord (one-note chord) is held at this time, the audio signals at the bass root output (Pin 7) and bass 5th output (Pin 6) are the root and 5th components of the chord being played. The 5th bass signal is routed to Pin 12 of IC10A. The root bass signal is routed to Pin 2 of IC10A.

NOTE: **With the rhythm tabs turned off, only the Low/Root bass will be heard.**

IC10A, IC16A HIGH/LOW BASS SELECT, DIVIDER

The High/Low Bass Select IC10A has as its inputs at Pins 12 and 2 the high/fifth bass and the low/root bass from Pins 6 and 7 of the CFG. When all rhythms are off, Pin 1 of IC10A is held high and Pin 13 is held low. This enables only the Low/Root Bass signal to be outputted from IC10A. Turning on a rhythm tab causes the inputs at Pins 1 and 13 to alternately switch high and low. The audio output at Pin 3 of IC10A will now be an alternating high/low signal. The audio signal applied to IC16A is frequency divided in half then applied to the Genie Bass Keyer Q30 (see Schematic 14).

IC9A, IC9B PULSE DETECTOR, AUDIO DETECTOR

Pulse Detector IC9A is enabled when a rhythm tab is on. When the rhythm is playing, Bass Keyer Pulses are outputted by the RFG. Each positive pulse is inverted through IC9A and applied as a low to Audio Detector IC9B. Pin 3 of IC9B is normally high. When Genie Bass audio is outputted by the CFG, Diode D8 rectifies the audio signal into DC voltage. Audio Detector IC9B (Pin 3) senses this as a low. Since both inputs are low, IC9B outputs a positive pulse. This pulse is applied to the Genie Bass Driver (see Schematic 14).

BASS PEDALS

IC5 PEDAL LATCH

The CFG/Pedal Oscillator IC7 applies 500KHz directly to the Pedal Latch IC5. The Pedal latch contains the required logic to generate five octave frequencies (1, 2, 4, 8, 16) corresponding to the pedal that is pressed. The Pedal Latch has a low note priority. This enables the lowest pedal (farthest to the left) to have an output when two or more pedals are pressed together. Once a pedal is pressed and released, the audio outputs remain until a new pedal is pressed. The pedal keyswitch inputs are normally high (+14.5 volts) and go low (ground) when active. Each time a pedal is pressed, a negative going pulse is outputted at Pin 2. The output at Pin 16 switches low for the duration of the pedal down.

A capacitor is connected to each pedal keyswitch input (Pins 3-15). The pull-up resistor at Pin 15 (C2 pedal input) has higher resistance than the other pedal pull-up resistors, giving the capacitor at Pin 15 a longer charging time constant. At power turn on, Pin 15 momentarily remains low (due to the long time constant). The Pedal Latch senses this as a pedal down and latches on the C2 pedal frequencies.

NOTE: **Only the Pedal 1- and 2-foot frequency outputs are used.**

IC10B OCTAVE SELECT

The 1' pedal bass audio is applied to Pin 9 of IC10B and the 2' pedal bass audio is applied to Pin 5. Normally, the 2' audio is routed through Octave Select IC10B and is used as the Phase-locked Loop reference frequency when Magic Melody and Swing Bass are played from the bass pedals. The 1' audio signal will be selected and applied to the Phase-locked Loop when a bass pedal (C1-E1) is pressed (see 1' Enable).

IC12A, IC12D 1' ENABLE FLIP-FLOP

This set/reset flip-flop is 'set' high at IC12A Pin 3 when Pin 1 of IC12A is applied low when a bass pedal (C1-E1) is pressed. Pin 3 of IC12A switches high, enabling the 1' pedal audio to be applied to the Phase-locked Loop. The high from IC12A Pin 3 is inverted to a low by IC11E disabling the 2' pedal audio. Each time a bass pedal is pressed, a negative going pulse is outputted at Pin 2 of Pedal Latch IC5. This pulse is applied to Pin 13 of IC12D, resetting IC12A Pin 3 low. If a pedal C1-E1 is pressed, the Phase-locked Loop reference is at a 1' pitch. If a pedal F1-C2 is pressed, the Phase-locked Loop reference is a 2' pitch.

CFG/AOC SYNC and SCAN CLOCK

The CFG/Pedal Oscillator Frequency (500KHz) is divided in half by IC16B. The Q-bar output (IC16B Pin 12) applies 250KHz to the CFG. The Q output (IC16B Pin 13) is divided-by-two twice by IC22B and IC22A. The 62.5KHz square wave is used to clock the Magic Genie AOC Decoder.

IC21B, IC21A SYNC PULSE TRIGGER

The CFG serial data has 72 distinct time points. At time point 72 (end of scan) a sync pulse is outputted from Pin 22 of the CFG and applied to the clock input of the Sync Pulse Trigger IC21B Pin 11. The data input to IC21B is high (+14.5V). When the sync pulse occurs, the high at the data is transferred to the Q output (IC21B Pin 13). The Q output of IC21B is connected to the D input of IC21A (Pin 5). On the next clock pulse outputted by divider IC16B, the Q-bar output (Pin 2 of IC21A) switches low applying a sync pulse to Magic Genie AOC Decoder IC6. The Q output (Pin 1 of IC21A) switches high which resets the Q output of IC21B low. The next clock pulse applied to IC21A switches the Q output low and the Q-bar output high (because the Q output of IC21B was reset low).

IC12C, IC11C, IC12B SERIAL DATA ENABLERS

When the Magic Genie Chord tabswitch is on, positive voltage is applied to Pin 9 of IC12C. This enables serial data (corresponding to the three or four note Magic Chord) to pass through IC12C and IC11C to IC12B Pin 5. If the rhythm is not auto stopped, Pin 6 of IC12B will be high enabling the serial data to pass through IC12B to Magic Genie AOC Decoder IC6.

IC6 MAGIC GENIE AOC DECODER

Serial Data from the Chord Function Generator is shifted into Decoder IC6. When a sync pulse is applied to the strobe input (Pin 37), the serial data is latched in the Decoder and outputted at Pins 11-22. Active outputs switch high (+14.5V). The high level outputs are applied to the AOC Drivers (see Schematic 4).

SCHEMATIC 16

POWER SUPPLY

AC line voltage is converted into positive and negative DC supply voltages using transformer T1 and rectifier bridge D1. The pushbutton lamp voltage is regulated by IC1. The +15 volt supply is regulated by IC2 and the -15 volt supply is regulated by IC3. The positive and negative supply voltages are applied through decoupling resistors located on various boards. Zener diodes provide regulation to some of the circuits. A separate winding on T1 provides 12VAC for the tab panel lamps.

AC line voltage is converted into positive DC supply voltage using transformer T1 and rectifier bridge D2. This voltage is applied to the three amplifiers. A zener diode regulates the voltage applied to the expression pedal photocell bulb.

A 3-amp slo-blo fuse is employed in the primary circuit of the power supply to prevent component damage which may be caused by a short circuit. Each power amplifier is protected by a 3-amp slo-blo fuse at its DC input.

SCHEMATIC 17

CROSSOVER FILTERS AND AMPLIFIERS

IC2A, IC2B BASS LOW-PASS FILTER

Audio from the Main One and Main Two Output Amps is summed together through 10K resistors and applied to the Bass Low-Pass Filter. This filter removes all but the low frequency signal (filter cutoff is approximately 180Hz) and applies it to the Bass Amplifier.

Q17, Q19 FILTERS

Audio from the Main One and Main Two Output Amps is applied to its respective filter circuit. The filters pass the high frequencies (above 180Hz) to their respective amplifiers.

AMPLIFIER

The function of the preamp is to boost the signal voltages to a point where they can be used by the driver and pre-driver circuits. The Differential Preamp Q2 senses the signal at the output of the amplifier and controls it by regulating the signal input at the preamp. The pre-driver Q1 inverts the audio voltage and applies it to the Driver Q3. The output transistors convert the audio voltages from the driver into high-current, low-voltage output signal that is connected via Relay RL1 to the speakers.

Q12, Q16 RELAY DRIVERS

At power turn on, the 100uf capacitor at the base of Q12 begins to charge. When this capacitor has charged (approximately 8 seconds), Q12 turns on. Positive voltage is applied to Q16 causing Q16 to turn on energizing the speaker relay. The relay will de-energize when a headset is plugged into the headphone jack.

Q14 ORGAN 'OFF' DISCHARGE SWITCHER

The voltage at the base of Q14 is slightly negative, keeping Q14 biased off. At organ turn off, the -25 volt supply collapses instantly (because there is no filter capacitor in the power supply). The base of Q14 switches positive which discharges the 100uf capacitor to ground and de-energizes the speaker relays.

ADJUSTMENTS

All adjustments have been made at the factory. Normally, the only time an adjustment would be required in the field is when a repair has been made to the specific circuit where the adjustment is located.

NOTE: Unless specified, all tabs are off and controls at minimum.

SCHEMATIC 1

Board A

MASTER OSCILLATOR TUNING PROCEDURE

1) Press the upper 16-foot Trombone tab.
2) Hold down an upper keyswitch (C2 for example).
3) Using a tuning fork or electronic tuning device corresponding to the key being held (in this case C2) adjust the coil using a non-metalic tuning wand for a zero beat between the organ tone and the tuning device.
4) When this note is properly tuned, the TOS tuning is locked in.
5) Press the Genie String Bass tab and the Bass Full tab.
6) Hold down the upper C2 and the lower C3 keyswitches. No roll or beat should be heard. If a roll or beat is heard, perform the CFG/Pedal oscillator Tuning Procedure.

SCHEMATIC 2

Board J

TRUMPET MUTE LEVEL SET

1) Connect negative (ground) voltmeter lead to -15 volt supply.
2) Connect positive lead to collector of Q13.
3) Voltmeter should read between 2.7 volts and 3.7 volts DC.
4) If adjustment is required, substitute the resistor at the base of Q13 with a decade box, resistor substitution box or a potentiometer. The initial value should be approximately 330K ohms.
5) Adjust for 3.2 volts DC.
6) Install fixed component and check voltage at the collector of Q13.

VIBRATO SPEED ADJUSTMENT

1) Connect oscilloscope to Pin 1 of IC1A Vibrato Oscillator.
2) Turn Vibrato Speed Adjust VR1 until one cycle takes approximately 160mS to complete.
3) This correctly adjusts the vibrato speed for 6.3Hz.

VIBRATO DEPTH ADJUSTMENT

1) Check vibrato speed adjustment.
2) Connect oscilloscope to wiper of Vibrato Depth Adjust VR2.
3) Turn Vibrato Tab on.
4) Adjust VR2 for 3.2V peak to peak.

SCHEMATIC 4

Board D

AOC RANGE ADJUSTMENT

1) Turn all upper and lower keyboard tabs off.
2) Turn on upper keyboard 8-foot Flute tab.
3) Hold down the lower keyboard C1 keyswitch.
4) Play a chromatic scale on the upper keyboard C2 to C3 keyswitches.
5) AOC note should be heard on nine notes D#2 through B3.
6) If more (or less) than nine notes are heard, adjust AOC Range Adjustment VR1 for a nine note range.

SCHEMATIC 7

Board L

CHORUS BIAS ADJUSTMENT

To adjust the DC offset voltage:

1) Turn Chorus Select switch to Celeste position.
2) Turn Main Chorus tab on.
3) Turn Upper Trombone tab on.
4) Hold down an upper keyboard key and turn the potentiometer in both directions until distortion occurs. Proper setting is the midpoint between the distortion regions.

SCHEMATIC 8

Board H

PERCUSSION THUMP ADJUSTMENT

The purpose of this adjustment is to minimize the DC transient (thump) which may occur when playing any of the repeat percussion voices (Harmonic 4', 2-2/3', Mandolin and Banjo). To adjust:

1) Place expression pedal at maximum expression.
2) Turn rhythm speed control to minimum.
3) Turn Repeat tab on.
4) Turn Banjo preset on.
5) Adjust VR2 for minimum thump.

NOTE: If thump cannot be reduced satisfactorily by adjustment, then replace Modulator IC3.

GENIE THUMP ADJUSTMENT

The purpose of this adjustment is to minimize the DC transient (thump) which may occur when the lower keyboard Piano, Banjo or Guitar tabs are on and a rhythm is playing. To adjust:

1) Place expression pedal at maximum expression.
2) Turn rhythm volume controls to minimum.
3) Place rhythm balance control to Brush (extreme top of control movement).
4) Select Metronome Rhythm.
5) Adjust VR1 for minimum thump.

NOTE: If thump cannot be reduced satisfactorily by adjustment, then replace Modulator IC5.

SCHEMATIC 10

Board V

MAXIMUM VOLUME ADJUSTMENT

1) Press upper Trombone and Clarinet tabs.
2) Place Expression Pedal at maximum (Full volume).
3) Press the upper C1, E1, G2, A#2 and C2 keyswitches simultaneously (C7 chord).
4) Adjust Maximum Volume potentiometer for maximum volume without audible distortion.

MINIMUM VOLUME ADJUSTMENT

1) Press lower Piano tab and lower Full tab.
2) Place expression pedal at minimum (softest volume).
3) Press lower C2 keyswitch.
4) Adjust Minimum Volume potentiometer until the audio signal is barely audible.

SCHEMATIC 15

Board R

CFG/PEDAL OSCILLATOR TUNING PROCEDURE

1) Check tuning of Master Oscillator. (See Master Oscillator Tuning Procedure.)
2) Press the upper 16-foot Trombone tab.
3) Press the lower Genie String Bass tab and Bass Full tab.
4) Hold down the upper keyboard C2 keyswitch and the lower keyboard C3 keyswitch.
5) Tune the CFG/Pedal Oscillator tuning coil (L1) for a zero beat with the upper keyboard tone using a non-metalic tuning wand.
6) When this note is properly tuned, the CFG and Bass Pedal tuning is locked in.

MAGIC CHORD LEVEL ADJUSTMENT

1) Press lower 8-foot Flute tab.
2) Hold down the lower keyboard G1, C2 and E2 keyswitches.
3) Release the keys.
4) Place Magic Chord tab on.
5) Press C1 keyswitch (C chord).
6) Adjust Chord Level potentiometer for equal volume between the Flutes in both the chord and non-chord modes. (Repeat Steps 2 through 6 as required.)

SCHEMATIC 17

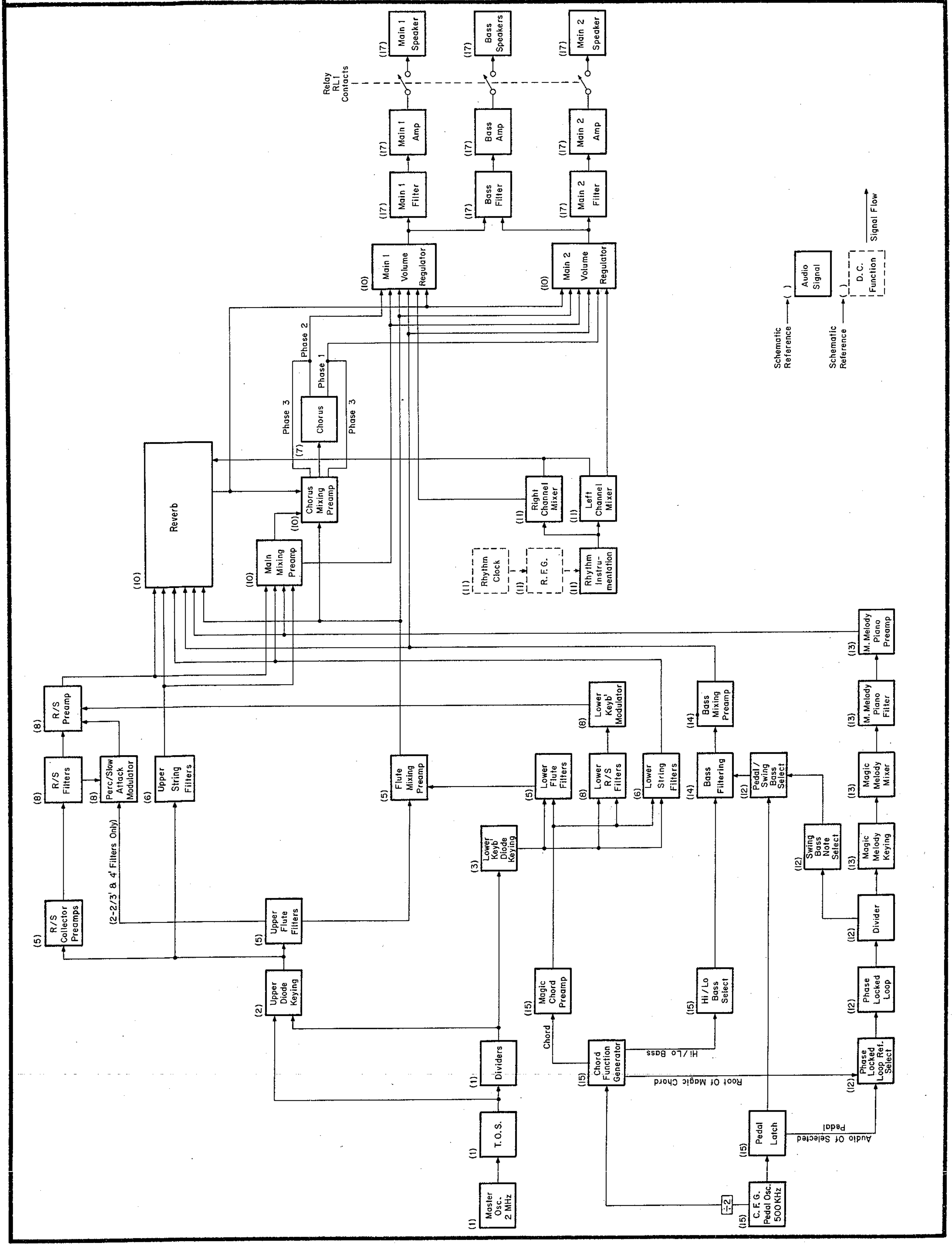
Board T

AMPLIFIER BIAS ADJUSTMENT

[To be performed after replacement of amplifier components]

1) Unplug organ, remove back and expose the component side of the Power Supply/Amplifier chassis.
2) Remove the 3-amp fuse located on the Amplifier Board.
3) Connect a milliammeter to the fuse posts (positive lead to +55 volts, negative lead to collector of Q5).
5) Turn on power and allow Power Supply to stabilize.
6) Current should read between 20 and 30 mA.
7) If adjustment is necessary, turn off power and remove the factory-tailored resistor.
8) Connect a variable resistor (decade box, potentiometer, resistor substitution box, etc.) to the wire wrap pins. The initial value should be approximately 10K ohms.
9) Turn on power and allow power supply to stabilize.
10) Adjust variable resistor for a curent reading of 25mA.
11) Turn off power and solder proper resistor to wire wrap pins.
12) Turn on power and check current.
13) Turn off power, remove milliammeter leads, insert fuse.

AUDIO SIGNAL FLOW BLOCK DIAGRAM



(17) Main 1 Speaker
(17) Bass Speakers
(17) Main 2 Speaker
Relay RL1 Contacts
(17) Main 1 Amp
(17) Bass Amp
(17) Main 2 Amp
(17) Main 1 Filter
(17) Bass Filter
(17) Main 2 Filter
(10) Main 1 Volume Regulator
(10) Main 2 Volume Regulator
Phase 2
Phase 1
Phase 3
Phase 3
(7) Chorus
(10) Chorus Mixing Preamp
(10) Main Mixing Preamp
(10) Reverb
(11) Right Channel Mixer
(11) Left Channel Mixer
(11) Rhythm Clock
(11) R. F. G.
(11) Rhythm Instru-mentation
(13) M. Melody Piano Preamp
(13) M. Melody Piano Filter
(13) Magic Melody Mixer
(13) Magic Melody Keying
(12) Divider
(12) Phase Locked Loop
(12) Phase Locked Loop Ref. Select
(12) Swing Bass Note Select
(12) Pedal / Swing Bass Select
(14) Bass Mixing Preamp
(14) Bass Filtering
(15) Hi / Lo Bass Select
(15) Pedal Latch
(15) C. F. G. Pedal Osc. 500KHz
÷2
Audio Of Selected Pedal
Root Of Magic Chord
Hi / Lo Bass
Chord
(15) Chord Function Generator
(15) Magic Chord Preamp
(8) Lower Keyb' Modulator
(5) Lower Flute Filters
(8) Lower R/S Filters
(6) Lower String Filters
(3) Lower Keyb' Diode Keying
(5) Flute Mixing Preamp
(1) Dividers
(1) T. O. S.
(1) Master Osc. 2 MHz
(2) Upper Diode Keying
(5) Upper Flute Filters
(5) R/S Collector Preamps
(2-2/3' & 4' Filters Only)
(8) R/S Filters
(8) Perc/Slow Attack Modulator
(6) Upper String Filters
(8) R/S Preamp
Schematic Reference ( ) Audio Signal
Schematic Reference ( ) D.C. Function
Signal Flow

OSCILLOSCOPE USAGE

An oscilloscope provides a visual image of events which occur too rapidly to be measured with a voltmeter. When properly used, the oscilloscope becomes a valuable aid in troubleshooting electronic organs.

INPUT COUPLING

The input coupling on most oscilloscopes can be switched between direct (DC) or decoupled (AC).

Direct Coupling [DC]

1. The probe is connected directly to the input of the oscilloscope.
2. Once a zero reference is established, positive and negative voltage measurements can be made.
3. Unless otherwise specified, all waveforms shown on the schematics are made using direct coupling.

Decoupled [AC]

1. A capacitor is placed in series with the probe to block any DC voltage which may be present in the AC signal.
2. The image on the oscilloscope will deflect above and below the established zero reference.

Input - DC
Vertical - 5 Volts per Division
Trigger - Auto

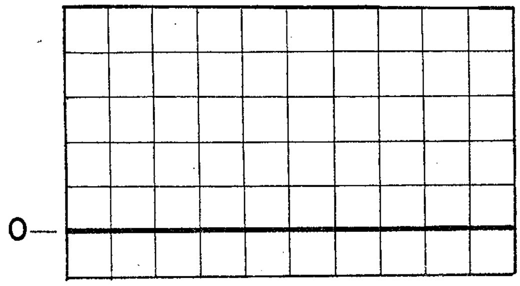


Fig. 6A - Establish Zero Reference

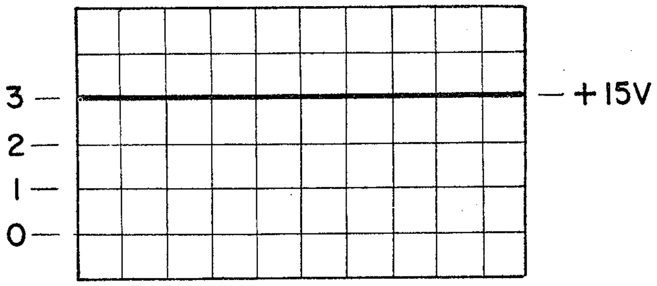


Fig. 6B - Three Division Deflection

CALIBRATION

Any oscilloscope may be calibrated as follows:

1. Set vertical deflection to 5 volts/division (or similar range).
2. Ground the input to the oscilloscope.
3. Align the trace with a horizontal graticule (see Fig. 6A).
4. Unground the input to the oscilloscope, trace should not move.
5. Connect oscilloscope input to a known DC voltage source (i.e. +15 volts).
6. Trace should deflect three divisions in a vertical direction [3 division x 5 volts = 15 volts]. (See Fig. 6B.)
7. Adjust calibration control to obtain a three division (15 volt) deflection.
8. Oscilloscope is now calibrated.

NOTE: If a ten-to-one (or other) attenuator probe is used, the vertical deflection should be multiplied by ten (or other). For example: With a ten-to-one probe, the vertical deflection would have to be set to .5 volts per division to obtain a three division deflection when measuring a 15 volt source.

.5V x 3 Div. = 1.5V   1.5V x 10 atten. = 15V

TIME BASE

Most oscilloscopes have a horizontal time base which controls the movement (sweep) of the trace across the screen from a few seconds to several microseconds.

Frequency and time are inverse functions. As frequency increases, time decreases. The mathematical formula for determining the frequency of a waveform is $F = \frac{1}{t}$ where frequency (F) is in cycles and time (t) is in seconds.

To determine the frequency of a waveform:

1) Determine the time it takes for the waveform to complete one cycle.
2) In Figure 7, a cycle of the waveform takes five divisions. The sweep is set for 200 microseconds per division. The time required for a single cycle is 200uS x 5 divisions or 1000 microseconds = 1 millisecond = .001 second.
3) Using the formula $F = \frac{1}{t}$, the frequency of the waveform is:

$$F = \frac{1}{.001}$$

$$F = 1000\text{Hz}$$

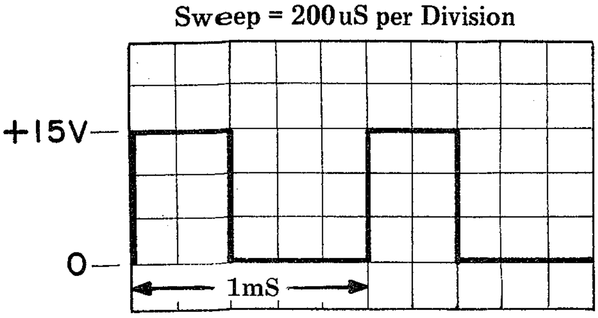


Fig. 7 - Determining Frequency

When observing a waveform, at least two cycles (repetitions) should be observed. This ensures that all of the event (i.e. serial data) is observed. Figure 8A shows a waveform observed with a 20 millisecond per division sweep. When the sweep is decreased to 100 milliseconds per division, two complete serial data cycles can be seen (see Fig. 8B). The sweep may now be increased to display the best image of the event.

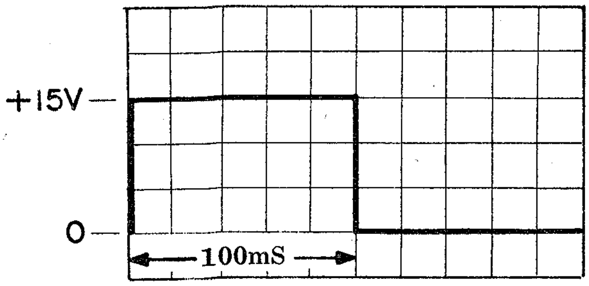


Fig. 8A - Serial data observed with 20mS per Division sweep

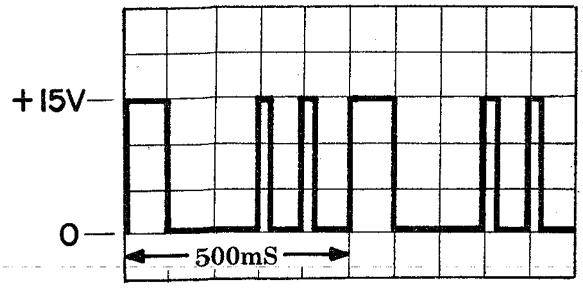


Fig. 8B - Serial data observed with 100mS per Division sweep

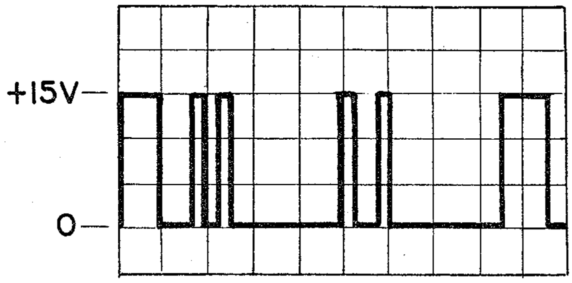


Fig. 9A - Internally Triggered Data

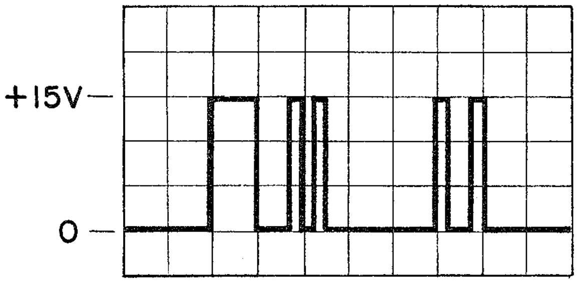


Fig. 9B - Externally Triggered Data

TRIGGERING

Some oscilloscopes have triggered sweep. There are two common types of triggered sweep. Internal triggering relies on the positive or negative going edge of the waveform to start the sweep. The trigger level is controlled by a potentiometer which will cause the sweep to start at the selected voltage level. External triggering is most useful for observing events which occur in a specific relationship to time. Serial data from the Chord Function Generator or Flute Encoder would be an example. Figure 9A shows data being triggered internally. As data bits are added or subtracted from the serial data stream, the image on the oscilloscope will shift dependent on the first data bit (farthest left) used for triggering. The pattern in Figure 9B is externally triggered using the positive edge of the T1 time frame. As data bits are added or subtracted, they will always appear in the same position with respect to the triggering source.

IMPORTANT INFORMATION

SCHEMATIC DRAWINGS, PRINTED WIRING BOARDS

1) The numbering on each printed wiring board begins with Q1, IC1 and D1.
2) Board locations are clearly shown in large letters.
3) Two or more components with the same reference number may be drawn on the same schematic.
4) When components from two or more printed wiring boards are drawn on the same schematic, shaded areas will separate the components and their location will be clearly identified.

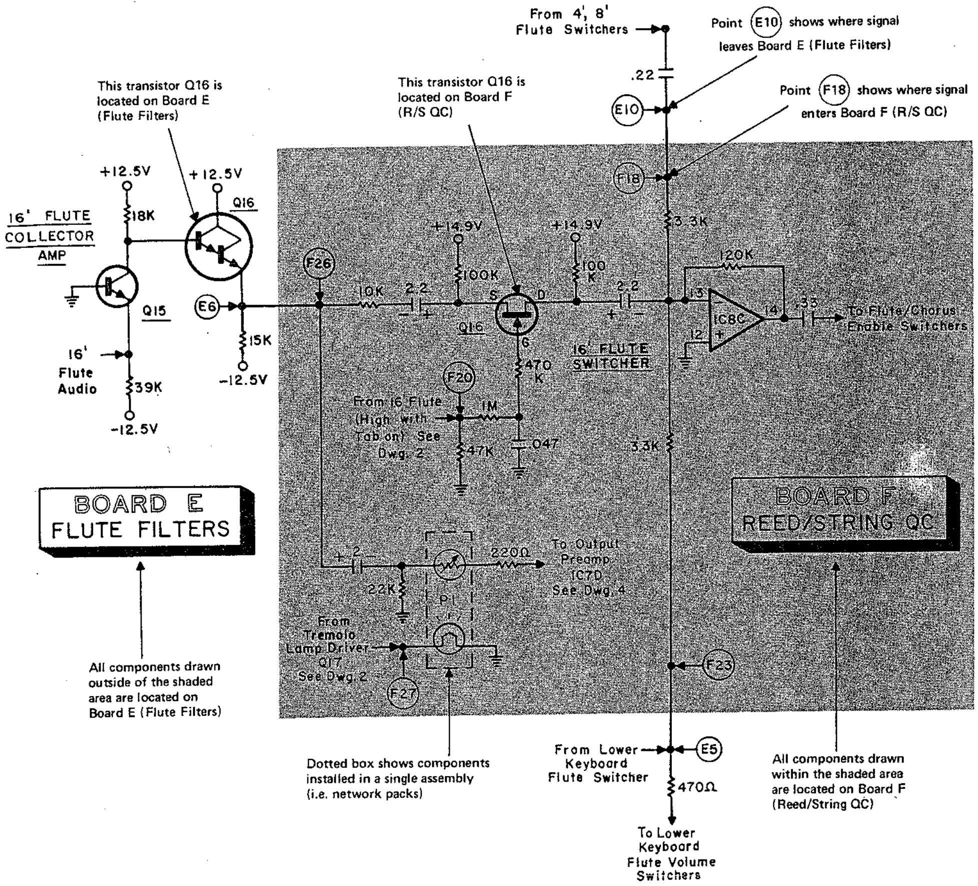
TEST EQUIPMENT

1) All voltages are measured with a Simpson 260 VOM to ground reference.
2) Oscilloscope waveforms are approximations.
3) Unless specified, measurements are made with keyswitches, tabswitches and pushbutton switches in the "off" position and controls at minimum.

NOTE: Actual voltages and waveshapes will vary depending on the accuracy of your test equipment, loading, component tolerances, power supply voltages and other variables.

COMPONENTS

1) Resistors have 5 or 10% tolerances and are rated at 1/4 or 1/2 watt unless otherwise specified.
2) Capacitor values are in microfarads (uf) unless otherwise specified.
3) All components are located on indicated boards unless specified.
4) See Parts List for component part numbers.
5) ✠ Denotes factory-tailored component.
6) Resistors with "R" numbers and capacitors with "C" numbers are located in networks or listed in charts as indicated on individual drawings.


From 4', 8'
Flute Switchers
.22
E10
F18
3.3K
120K
+12.5V
18K
+12.5V
Q16
16' FLUTE
COLLECTOR
AMP
Q15
E6
15K
-12.5V
16'
Flute
Audio
39K
-12.5V
F26
10K
2.2
+14.9V
100K
S
D
Q16
G
470 K
+14.9V
100 K
2.2
13
IC8C
14
12
.33
To Flute/Chorus
Enable Switchers
16' FLUTE
SWITCHER
F20
From 16' Flute
(High with
Tab on) See
Dwg. 2
1M
47K
.047
3.3K
BOARD E
FLUTE FILTERS
BOARD F
REED/STRING QC
2
22K
P1
220Ω
To Output
Preamp
IC7D
See Dwg. 4
From
Tremolo
Lamp Driver
Q17
See Dwg. 2
F27
F23
From Lower
Keyboard
Flute Switcher
E5
470Ω
To Lower
Keyboard
Flute Volume
Switchers

This transistor Q16 is located on Board E (Flute Filters)

This transistor Q16 is located on Board F (R/S QC)

Point (E10) shows where signal leaves Board E (Flute Filters)

Point (F18) shows where signal enters Board F (R/S QC)

All components drawn outside of the shaded area are located on Board E (Flute Filters)

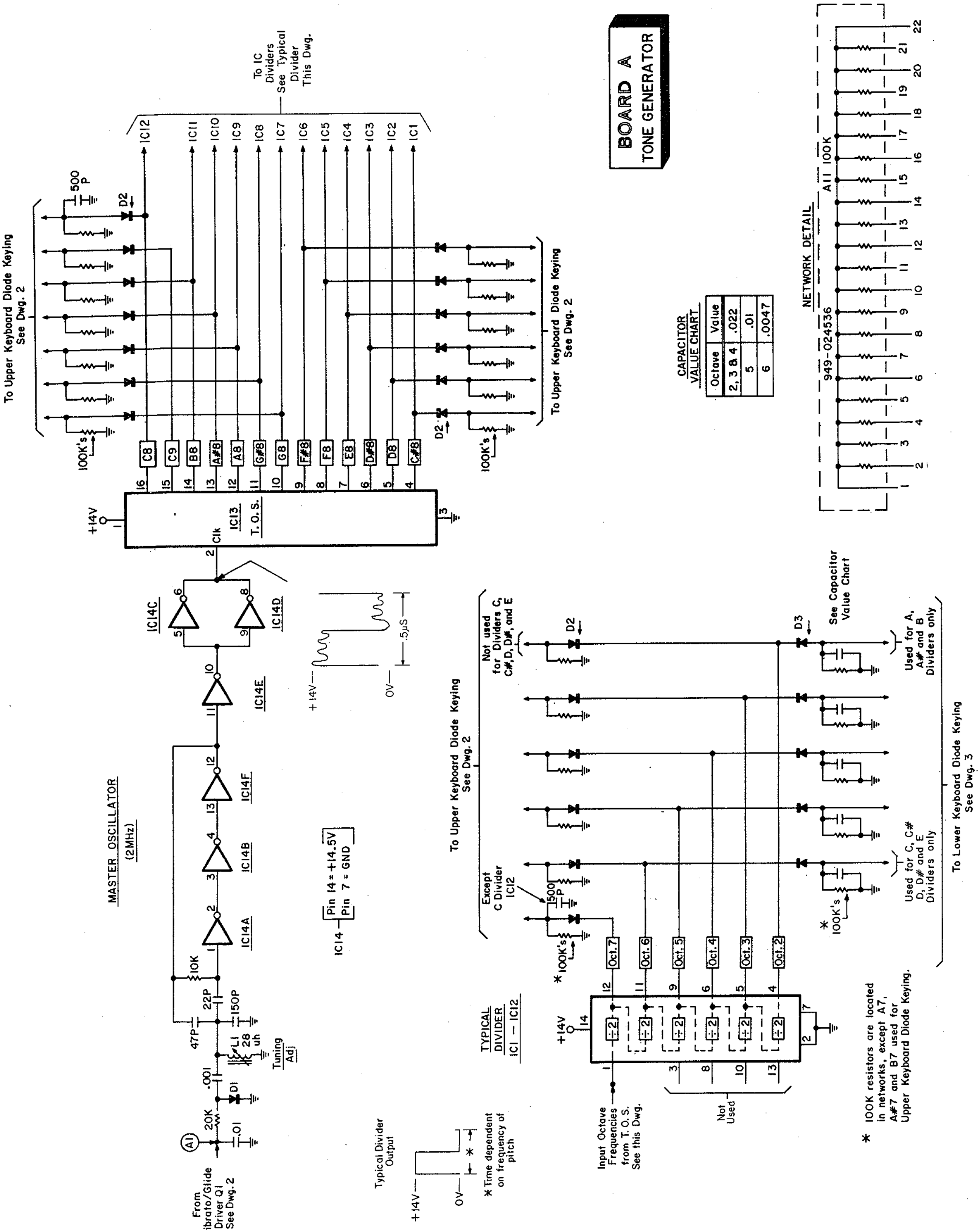
Dotted box shows components installed in a single assembly (i.e. network packs)

All components drawn within the shaded area are located on Board F (Reed/String QC)

Example

TONE GENERATOR

1


BOARD A
TONE GENERATOR
To IC Dividers See Typical Divider This Dwg.
IC12
IC11
IC10
IC9
IC8
IC7
IC6
IC5
IC4
IC3
IC2
IC1
500 P
D2
To Upper Keyboard Diode Keying See Dwg. 2
100K's
C8
C9
B8
A#8
A8
G#8
G8
F#8
F8
E8
D#8
D8
C#8
+14V
IC13
T.O.S.
Clk
IC14C
IC14D
IC14E
IC14F
IC14B
IC14A
+14V
0V
.5μS
IC14 Pin 14 = +14.5V
Pin 7 = GND
MASTER OSCILLATOR
(2MHz)
10K
22P
150P
47P
L1
28 uh
Tuning Adj
.001
D1
20K
.01
A1
From Vibrato/Glide Driver Q1 See Dwg. 2
Typical Divider Output
+14V
0V
* Time dependent on frequency of pitch
Not used for Dividers C, C#, D, D#, and E
Except C Divider IC12
D3
See Capacitor Value Chart
Used for A, A# and B Dividers only
Used for C, C# D, D# and E Dividers only
To Lower Keyboard Diode Keying See Dwg. 3
TYPICAL DIVIDER
IC1 — IC12
Oct. 7
Oct. 6
Oct. 5
Oct. 4
Oct. 3
Oct. 2
÷2
Not Used
Input Octave Frequencies from T.O.S. See this Dwg.
NETWORK DETAIL
949-024536
All 100K
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

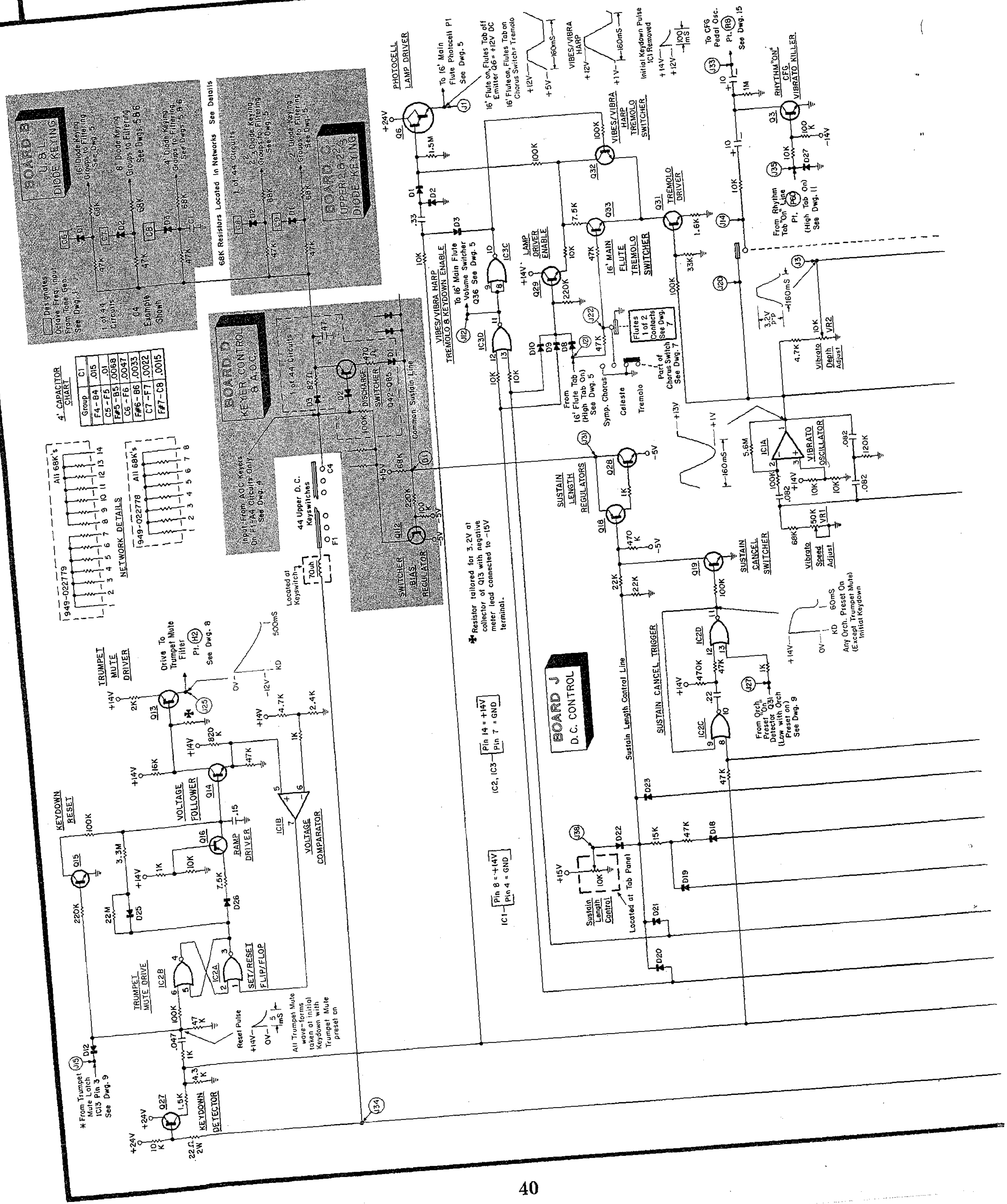
CAPACITOR VALUE CHART

Octave	Value
2, 3 & 4	.022
5	.01
6	.0047

* 100K resistors are located in networks, except A7, A#7 and B7 used for Upper Keyboard Diode Keying.

2

UPPER DIODE KEYING & DC CONTROL

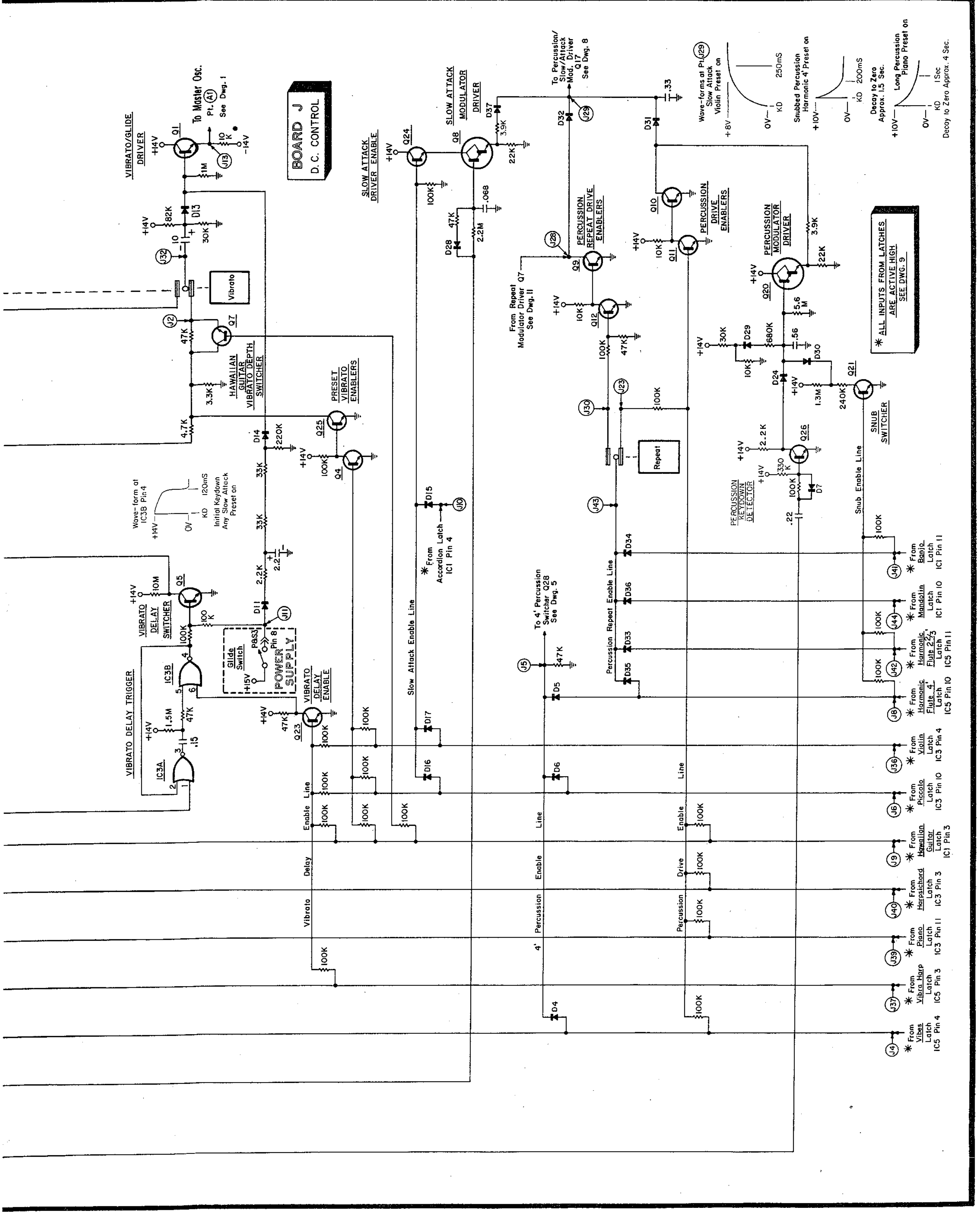

BOARD B U.S.L. DIODE KEYING
BOARD C UPPER 4' & 2 2/3' DIODE KEYING
BOARD D KEYER CONTROL & A.O.C.
BOARD J D.C. CONTROL
68K Resistors Located In Networks See Details
NETWORK DETAILS
949-022779
949-022778
All 68K's
4' CAPACITOR CHART
1 of 44 Circuits
C4 Example Shown
Designates Octave Freq. Input From Tone Gen. See Dwg. 1
16' Diode Keying Groups to Filtering See Dwg. 5
8' Diode Keying Groups to Filtering See Dwgs. 5 & 6
4' Diode Keying Groups to Filtering See Dwgs. 5, 8 & 6
2' Diode Keying Groups to Filtering See Dwg. 5
DISCHARGE SWITCHER
Common Sustain Line
SWITCHER BIAS REGULATOR
Input From AOC Keyers On F1 Thru C4 Circuits Only See Dwg. 4
44 Upper D.C. Keyswitches
Located at Keyswitch
PHOTOCELL LAMP DRIVER
To 16' Main Flute Photocell P1 See Dwg. 5
VIBES/VIBRA HARP TREMOLO & KEYDOWN ENABLE
To 16' Main Flute Volume Switcher Q36 See Dwg. 5
LAMP DRIVER ENABLE
16' MAIN FLUTE TREMOLO SWITCHER
VIBES/VIBRA HARP TREMOLO SWITCHER
TREMOLO DRIVER
RHYTHM "ON" CFG VIBRATO KILLER
To CFG Pedal Osc. Pt. R8 See Dwg. 15
From Rhythm Tab "On" Line Pt. P60 (High Tab On) See Dwg. 11
Vibrato Depth Adjust
VIBRATO OSCILLATOR
Vibrato Speed Adjust
SUSTAIN LENGTH REGULATORS
SUSTAIN CANCEL SWITCHER
SUSTAIN CANCEL TRIGGER
Sustain Length Control Line
Sustain Length Control
Located at Tab Panel
From Orch. Preset "On" Detector Q31 (Low with Orch Preset on) See Dwg. 9
Any Orch. Preset On (Except Trumpet Mute) Initial Keydown
From 16' Flute Tab (High Tab On) See Dwg. 5
Symp. Chorus
Celeste
Tremolo
Part of Chorus Switch See Dwg. 7
Flutes 1 of 2 Contacts See Dwg. 7
16' Flute on, Flutes Tab off Emitter Q6 = +12V DC
16' Flute on, Flutes Tab on Chorus Switch = Tremolo
Initial Keydown Pulse IC1 Removed
* Resistor tailored for 3.2V at collector of Q13 with negative meter lead connected to -15V terminal.
IC2, IC3 Pin 14 = +14V Pin 7 = GND
IC1 Pin 8 = +14V Pin 4 = GND
TRUMPET MUTE DRIVER
Drive To Trumpet Mute Filter Pt. H2 See Dwg. 8
KEYDOWN RESET
VOLTAGE FOLLOWER
RAMP DRIVER
VOLTAGE COMPARATOR
TRUMPET MUTE DRIVE
SET/RESET FLIP/FLOP
KEYDOWN DETECTOR
* From Trumpet Mute Latch IC13 Pin 3 See Dwg. 9
Reset Pulse
All Trumpet Mute wave-forms taken at initial Keydown with Trumpet Mute preset on
Q6 Q13 Q14 Q15 Q16 Q27 Q12 Q18 Q19 Q28 Q29 Q31 Q32 Q33 Q3
IC1A IC1B IC2A IC2B IC2C IC2D IC3C IC3D
J1 J3 J12 J14 J15 J20 J21 J22 J25 J27 J31 J33 J34 J35 J38
VR1 VR2
160mS 500mS 60mS 100mS

4' CAPACITOR CHART

Group	C1
F4 - B4	.015
C5 - F5	.01
F#5 - B5	.0068
C6 - F6	.0047
F#6 - B6	.0033
C7 - F7	.0022
F#7 - C8	.0015

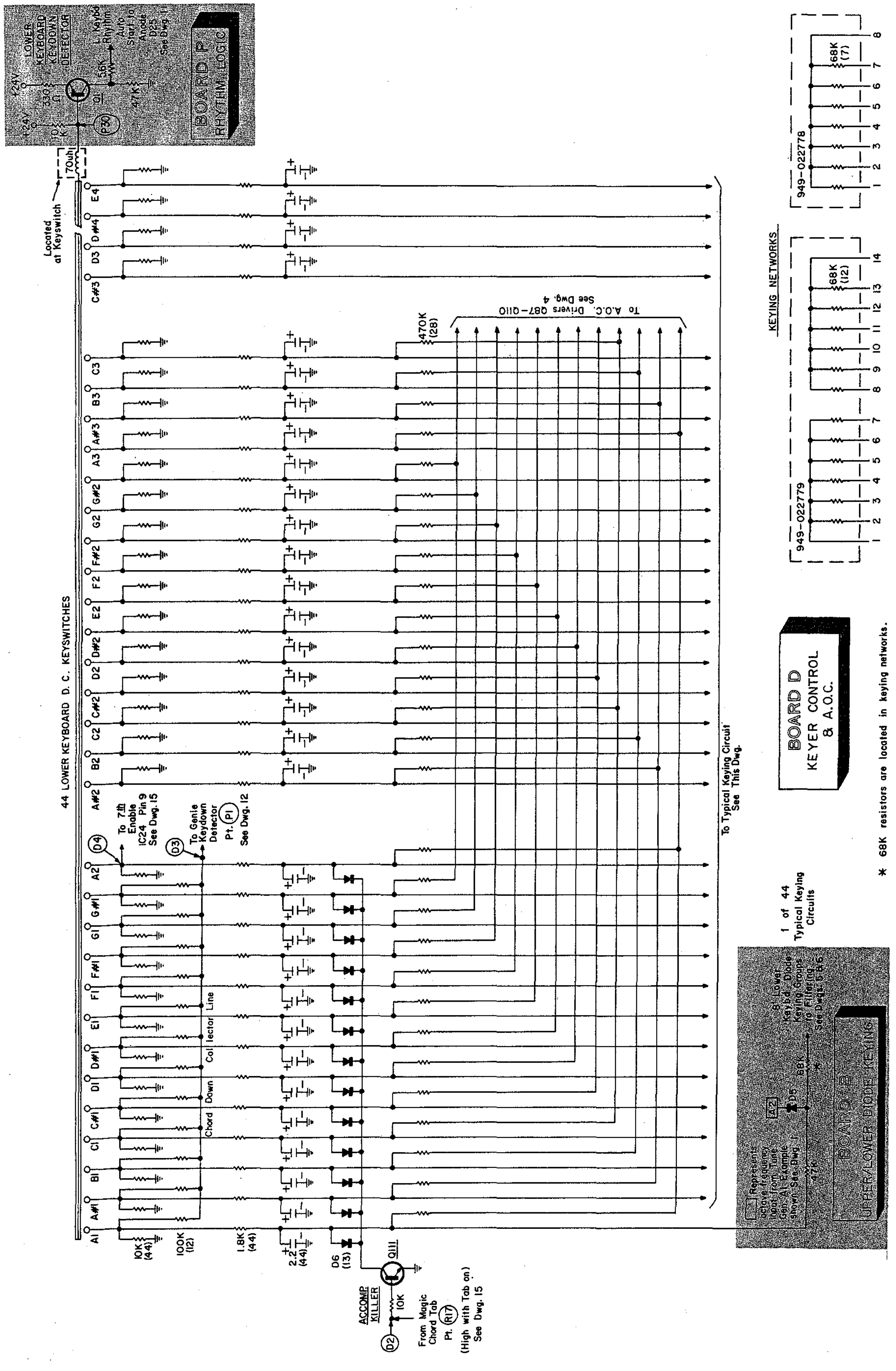
UPPER DIODE KEYING & DC CONTROL

2



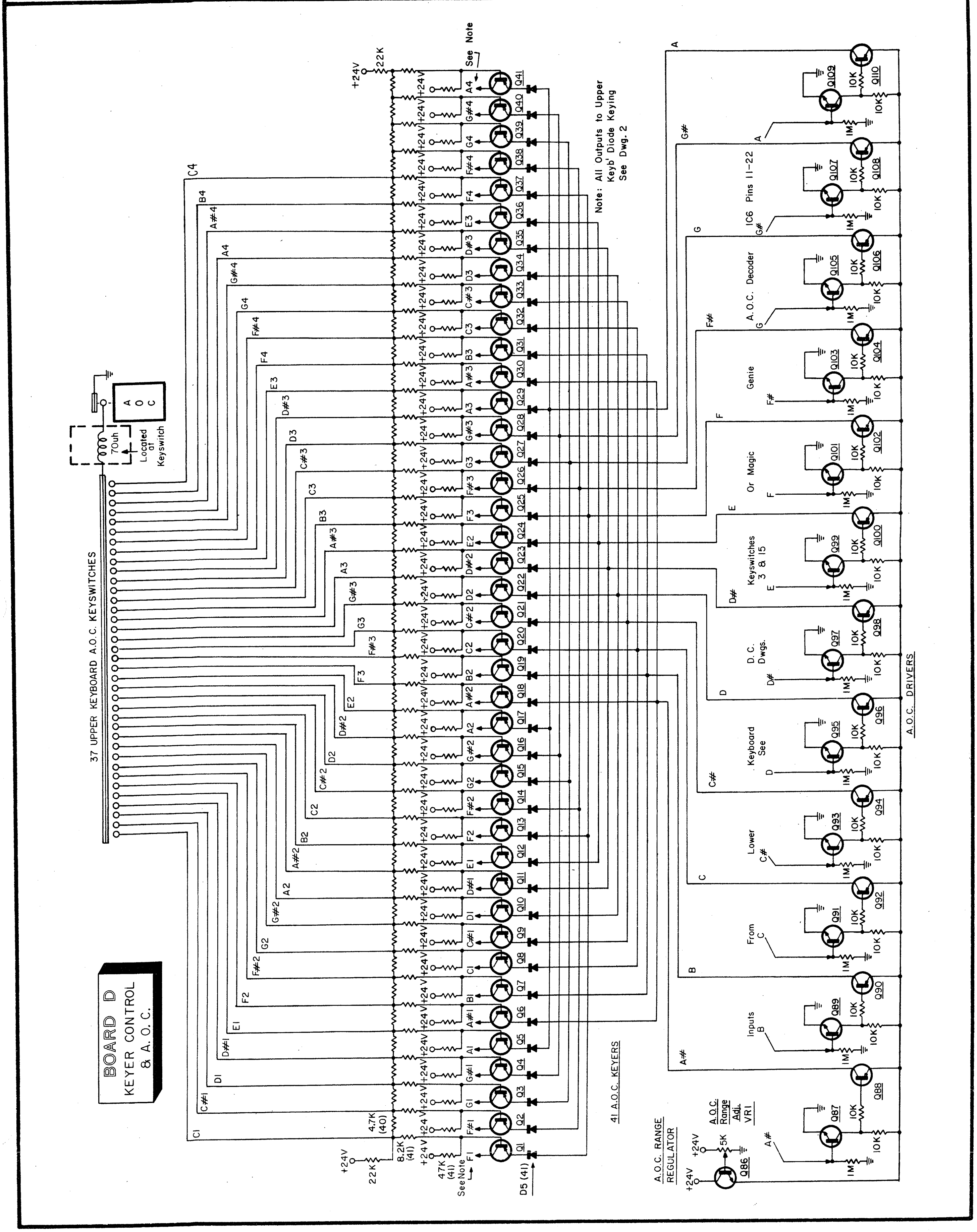
BOARD J
D. C. CONTROL
VIBRATO/GLIDE DRIVER
Q1
+14V
To Master Osc. Pt. (A1) See Dwg. 1
10 K
-14V
J13
1M
D13
82K
30K
10
J32
Vibrato
J2
Q7
47K
HAWAIIAN GUITAR VIBRATO DEPTH SWITCHER
3.3K
4.7K
PRESET VIBRATO ENABLERS
Q25
Q4
D14
220K
33K
100K
Wave-form at IC3B Pin 4
+14V
0V
KD
120mS
Initial Keydown Any Slow Attack Preset on
2.2K
2.2
D11
J11
VIBRATO DELAY SWITCHER
Q5
10M
100 K
Glide Switch
PBS3
Pin 8
+15V
POWER SUPPLY
VIBRATO DELAY TRIGGER
IC3B
IC3A
1.5M
47K
.15
VIBRATO DELAY ENABLE
Q23
SLOW ATTACK DRIVER ENABLE
Q24
SLOW ATTACK MODULATOR DRIVER
Q8
D37
3.9K
22K
.068
47K
2.2M
D28
D15
J10
From Accordion Latch IC1 Pin 4
Slow Attack Enable Line
D17
D16
To Percussion/ Slow/Attack Mod. Driver Q17 See Dwg. 8
J29
D32
D31
.33
PERCUSSION REPEAT DRIVE ENABLERS
J28
Q9
Q12
From Repeat Modulator Driver Q7 See Dwg. 11
PERCUSSION DRIVE ENABLERS
Q10
Q11
J30
J23
Repeat
J43
D34
D36
D33
D35
Percussion Repeat Enable Line
To 4' Percussion Switcher Q28 See Dwg. 5
J5
D5
D6
D4
4' Percussion Enable Line
Percussion Drive Enable Line
Vibrato Delay Enable Line
Wave-forms at Pt. J29 Slow Attack Violin Preset on
+8V
0V
KD
250mS
Snubbed Percussion Harmonic 4' Preset on
+10V
200mS
Decay to Zero Approx. 1.5 Sec.
Long Percussion Piano Preset on
1Sec
Decay to Zero Approx. 4 Sec.
PERCUSSION MODULATOR DRIVER
Q20
5.6 M
D29
680K
.56
D30
D24
1.3M
240K
Q21
SNUB SWITCHER
Q26
PERCUSSION KEYDOWN DETECTOR
330 K
D7
.22
Snub Enable Line
✱ ALL INPUTS FROM LATCHES ARE ACTIVE HIGH SEE DWG. 9
J41 ✱ From Banjo Latch IC1 Pin 11
J44 ✱ From Mandolin Latch IC1 Pin 10
J42 ✱ From Harmonic Flute 2⅔ Latch IC5 Pin 11
J8 ✱ From Harmonic Flute 4' Latch IC5 Pin 10
J36 ✱ From Violin Latch IC3 Pin 4
J6 ✱ From Piccolo Latch IC3 Pin 10
J9 ✱ From Hawaiian Guitar Latch IC1 Pin 3
J40 ✱ From Harpsichord Latch IC3 Pin 3
J39 ✱ From Piano Latch IC3 Pin 11
J37 ✱ From Vibra Harp Latch IC5 Pin 3
J4 ✱ From Vibes Latch IC5 Pin 4

3 LOWER DIODE KEYING


LOWER KEYBOARD KEYDOWN DETECTOR
+24V
+24V
330 Ω
10K
Q1
56K
47K
L. Keybd Rhythm Auto Start to Anode D25 See Dwg. 11
P30
BOARD P
RHYTHM LOGIC
170uh
Located at Keyswitch
E4
D#4
D3
C#3
C3
B3
A#3
A3
G#2
G2
F#2
F2
E2
D#2
D2
C#2
C2
B2
A#2
A2
G#1
G1
F#1
F1
E1
D#1
D1
C#1
C1
B1
A#1
A1
44 LOWER KEYBOARD D. C. KEYSWITCHES
10K (44)
100K (12)
1.8K (44)
2.2 (44)
D6 (13)
470K (28)
To A.O.C. Drivers Q87-Q110 See Dwg. 4
D4
To 7th Enable IC24 Pin 9 See Dwg. 15
D3
To Genie Keydown Detector Pt. P1 See Dwg. 12
Chord Down Collector Line
Q111
10K
ACCOMP KILLER
D2
From Magic Chord Tab Pt. R17 (High with Tab on) See Dwg. 15
To Typical Keying Circuit See This Dwg.
KEYING NETWORKS
949-022778
68K (7)
949-022779
68K (12)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
BOARD D
KEYER CONTROL & A.O.C.
1 of 44 Typical Keying Circuits
Represents octave frequency input from Tone Gen. A1 Example shown See Dwg. 1
A2
D5
47K
68K
8 Lower Keybd Diode Keying Groups to Filtering See Dwgs. 5 & 6
BOARD B
UPPER/LOWER DIODE KEYING
* 68K resistors are located in keying networks.

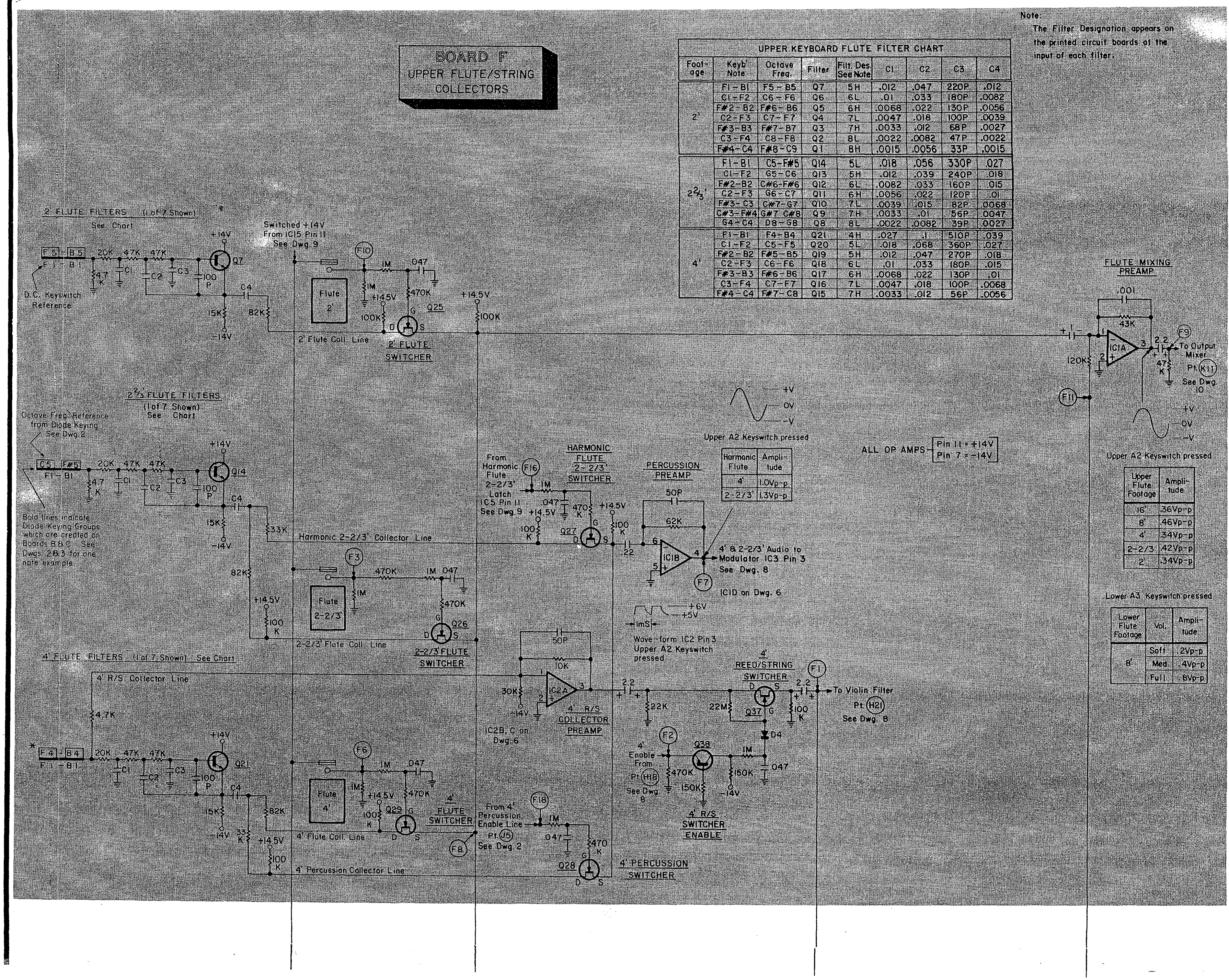
A.O.C.

4


BOARD D
KEYER CONTROL
& A.O.C.
37 UPPER KEYBOARD A.O.C. KEYSWITCHES
70uh
Located at Keyswitch
A O C
C1 C#1 D1 D#1 E1 F2 F#2 G2 G#2 A2 A#2 B2 C2 C#2 D2 D#2 E2 F3 F#3 G3 G#3 A3 A#3 B3 C3 C#3 D3 D#3 E3 F4 F#4 G4 G#4 A4 A#4 B4 C4
+24V
22K
4.7K (40)
8.2K (41)
47K (41)
See Note
D5 (41)
F1 F#1 G1 G#1 A1 A#1 B1 C1 C#1 D1 D#1 E1 F2 F#2 G2 G#2 A2 A#2 B2 C2 C#2 D2 D#2 E2 F3 F#3 G3 G#3 A3 A#3 B3 C3 C#3 D3 D#3 E3 F4 F#4 G4 G#4 A4
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29 Q30 Q31 Q32 Q33 Q34 Q35 Q36 Q37 Q38 Q39 Q40 Q41
41 A.O.C. KEYERS
Note: All Outputs to Upper Keyb' Diode Keying See Dwg. 2
A.O.C. RANGE REGULATOR
+24V
Q86
5K
A.O.C. Range Adj. VR1
A.O.C. DRIVERS
A# B C C# D D# E F F# G G# A
Q87 Q88 Q89 Q90 Q91 Q92 Q93 Q94 Q95 Q96 Q97 Q98 Q99 Q100 Q101 Q102 Q103 Q104 Q105 Q106 Q107 Q108 Q109 Q110
10K
1M
Inputs From Lower Keyboard See D.C. Dwgs. Keyswitches 3 & 15 Or Magic Genie A.O.C. Decoder IC6 Pins 11-22

5

UPPER & LOWER KEYBOARD FLUTE FILTERS


BOARD F
UPPER FLUTE/STRING
COLLECTORS
2' FLUTE FILTERS (1 of 7 Shown)
See Chart
F5 - B5
F1 - B1
D.C. Keyswitch Reference
20K
47K
47K
4.7 K
C1
C2
C3
100 P
+14V
Q7
C4
15K
82K
-14V
Switched +14V
From IC15 Pin 11
See Dwg. 9
F10
Flute 2'
1M
1M
.047
470K
+14.5V
100K
G
Q25
D
S
2' Flute Coll. Line
2' FLUTE SWITCHER
+14.5V
100K
2⅔' FLUTE FILTERS
(1 of 7 Shown)
See Chart
Octave Freq. Reference from Diode Keying See Dwg. 2
C5 - F#5
F1 - B1
Bold lines indicate Diode Keying Groups which are created on Boards B & C. See Dwgs. 2 & 3 for one note example.
Q14
33K
Harmonic 2-2/3' Collector Line
82K
+14.5V
100 K
F3
Flute 2-2/3'
470K
1M
.047
470K
Q26
2-2/3' Flute Coll. Line
2-2/3' FLUTE SWITCHER
From Harmonic Flute 2-2/3' Latch IC5 Pin 11 See Dwg. 9
F16
HARMONIC FLUTE 2-2/3' SWITCHER
470 K
+14.5V
100 K
Q27
.22
PERCUSSION PREAMP
50P
62K
IC1B
4' & 2-2/3' Audio to Modulator IC3 Pin 3 See Dwg. 8
F7
IC1D on Dwg. 6
+V
0V
-V
Upper A2 Keyswitch pressed
+6V
+5V
1mS
Wave-form IC2 Pin 3 Upper A2 Keyswitch pressed
ALL OP AMPS
Pin 11 = +14V
Pin 7 = -14V
4' FLUTE FILTERS (1 of 7 Shown) See Chart
4' R/S Collector Line
4.7K
*
F4 - B4
F1 - B1
Q21
33 K
F6
Flute 4'
Q29
4' FLUTE SWITCHER
4' Flute Coll. Line
4' Percussion Collector Line
F8
From 4' Percussion Enable Line Pt. J5 See Dwg. 2
F18
470 K
Q28
4' PERCUSSION SWITCHER
50P
10K
30K
IC2A
4' R/S COLLECTOR PREAMP
IC2B, C on Dwg. 6
2.2
22K
4' Enable From Pt. H18 See Dwg. 8
F2
Q38
470K
150K
150K
4' R/S SWITCHER ENABLE
22M
Q37
D4
4' REED/STRING SWITCHER
F1
To Violin Filter Pt. H21 See Dwg. 8
FLUTE MIXING PREAMP
.001
43K
120K
IC1A
F11
F9
47 K
To Output Mixer Pt. K11 See Dwg. 10

UPPER KEYBOARD FLUTE FILTER CHART								
Footage	Keyb' Note	Octave Freq.	Filter	Filt. Des. See Note	C1	C2	C3	C4
2'	F1 - B1	F5 - B5	Q7	5H	.012	.047	220P	.012
	C1 - F2	C6 - F6	Q6	6L	.01	.033	180P	.0082
	F#2 - B2	F#6 - B6	Q5	6H	.0068	.022	130P	.0056
	C2 - F3	C7 - F7	Q4	7L	.0047	.018	100P	.0039
	F#3 - B3	F#7 - B7	Q3	7H	.0033	.012	68P	.0027
	C3 - F4	C8 - F8	Q2	8L	.0022	.0082	47P	.0022
	F#4 - C4	F#8 - C9	Q1	8H	.0015	.0056	33P	.0015
2⅔'	F1 - B1	C5 - F#5	Q14	5L	.018	.056	330P	.027
	C1 - F2	G5 - C6	Q13	5H	.012	.039	240P	.018
	F#2 - B2	C#6 - F#6	Q12	6L	.0082	.033	160P	.015
	C2 - F3	G6 - C7	Q11	6H	.0056	.022	120P	.01
	F#3 - C3	C#7 - G7	Q10	7L	.0039	.015	82P	.0068
	C#3 - F#4	G#7 C#8	Q9	7H	.0033	.01	56P	.0047
	G4 - C4	D8 - G8	Q8	8L	.0022	.0082	39P	.0027
4'	F1 - B1	F4 - B4	Q21	4H	.027	.1	510P	.039
	C1 - F2	C5 - F5	Q20	5L	.018	.068	360P	.027
	F#2 - B2	F#5 - B5	Q19	5H	.012	.047	270P	.018
	C2 - F3	C6 - F6	Q18	6L	.01	.033	180P	.015
	F#3 - B3	F#6 - B6	Q17	6H	.0068	.022	130P	.01
	C3 - F4	C7 - F7	Q16	7L	.0047	.018	100P	.0068
	F#4 - C4	F#7 - C8	Q15	7H	.0033	.012	56P	.0056

Note:
The Filter Designation appears on the printed circuit boards at the input of each filter.

Upper A2 Keyswitch pressed

Harmonic Flute	Amplitude
4'	1.0Vp-p
2-2/3'	1.3Vp-p

Upper A2 Keyswitch pressed

Upper Flute Footage	Amplitude
16'	.36Vp-p
8'	.46Vp-p
4'	.34Vp-p
2-2/3	.42Vp-p
2'	.34Vp-p

Lower A3 Keyswitch pressed

Lower Flute Footage	Vol.	Amplitude
8'	Soft	.2Vp-p
	Med.	.4Vp-p
	Full	.8Vp-p

UPPER & LOWER KEYBOARD FLUTE FILTERS

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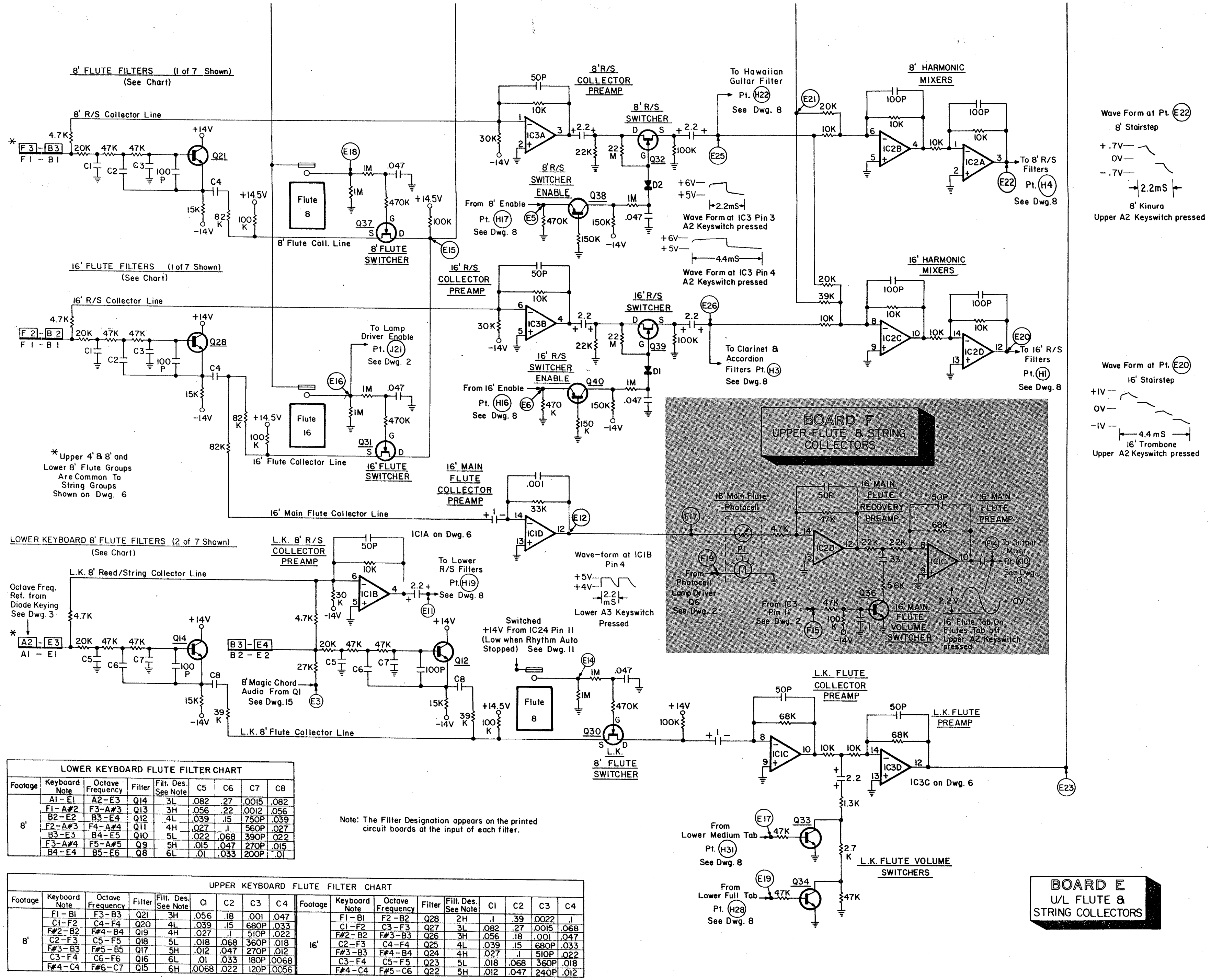

8' FLUTE FILTERS (1 of 7 Shown)
(See Chart)
8' R/S Collector Line
F3-B3
F1 - B1
4.7K
20K
47K
47K
C1
C2
C3
100P
+14V
Q21
C4
15K
-14V
82K
+14.5V
100K
E18
1M
.047
470K
Flute 8
Q37
G
S
D
8' Flute Coll. Line
8' FLUTE SWITCHER
E15
+14.5V
100K
8' R/S COLLECTOR PREAMP
50P
10K
IC3A
30K
-14V
2.2
22K
22M
8' R/S SWITCHER
Q32
D
S
G
100K
E25
8' R/S SWITCHER ENABLE
From 8' Enable
Pt. H17
See Dwg. 8
E5
470K
Q38
150K
1M
.047
D2
+6V
+5V
2.2mS
Wave Form at IC3 Pin 3
A2 Keyswitch pressed
4.4mS
Wave Form at IC3 Pin 4
A2 Keyswitch pressed
To Hawaiian Guitar Filter
Pt. H22
See Dwg. 8
E21
20K
10K
8' HARMONIC MIXERS
100P
10K
IC2B
IC2A
To 8' R/S Filters
E22
Pt. H4
See Dwg.8
Wave Form at Pt. E22
8' Stairstep
+.7V
0V
-.7V
2.2mS
8' Kinura
Upper A2 Keyswitch pressed
16' FLUTE FILTERS (1 of 7 Shown)
(See Chart)
16' R/S Collector Line
F2-B2
F1 - B1
Q28
To Lamp Driver Enable
Pt. J21
See Dwg. 2
E16
Flute 16
Q31
16' Flute Collector Line
16' FLUTE SWITCHER
82K
16' R/S COLLECTOR PREAMP
IC3B
16' R/S SWITCHER
Q39
E26
16' R/S SWITCHER ENABLE
From 16' Enable
Pt. H16
See Dwg. 8
E6
Q40
D1
To Clarinet & Accordion Filters Pt. H3
See Dwg.8
16' HARMONIC MIXERS
39K
IC2C
IC2D
E20
To 16' R/S Filters
Pt. H1
See Dwg. 8
Wave Form at Pt. E20
16' Stairstep
+1V
0V
-1V
4.4 mS
16' Trombone
Upper A2 Keyswitch pressed
16' Main Flute Collector Line
16' MAIN FLUTE COLLECTOR PREAMP
.001
33K
IC1D
E12
IC1A on Dwg. 6
BOARD F
UPPER FLUTE & STRING COLLECTORS
16' Main Flute Photocell
F17
P1
F19
From Photocell Lamp Driver Q6
See Dwg. 2
4.7K
16' MAIN FLUTE RECOVERY PREAMP
50P
47K
IC2D
22K
22K
.33
16' MAIN FLUTE PREAMP
68K
IC1C
F14
To Output Mixer Pt. K10
See Dwg. 10
From IC3 Pin 11
See Dwg. 2
F15
47K
100K
Q36
5.6K
-14V
16' MAIN FLUTE VOLUME SWITCHER
2.2V
0V
16' Flute Tab On Flutes Tab off Upper A2 Keyswitch pressed
Wave-form at IC1B Pin 4
+5V
+4V
2.2 mS
Lower A3 Keyswitch Pressed
LOWER KEYBOARD 8' FLUTE FILTERS (2 of 7 Shown)
(See Chart)
L.K. 8' Reed/String Collector Line
Octave Freq. Ref. from Diode Keying See Dwg. 3
A2-E3
A1 - E1
Q14
C5
C6
C7
C8
39K
L.K. 8' Flute Collector Line
L.K. 8' R/S COLLECTOR PREAMP
IC1B
30K
To Lower R/S Filters
Pt. H19
See Dwg. 8
E11
B3-E4
B2 - E2
27K
8' Magic Chord Audio From Q1
See Dwg.15
E3
Q12
Switched +14V From IC24 Pin 11 (Low when Rhythm Auto Stopped) See Dwg. 11
E14
Q30
L.K. 8' FLUTE SWITCHER
L.K. FLUTE COLLECTOR PREAMP
IC1C
L.K. FLUTE PREAMP
IC3D
IC3C on Dwg. 6
E23
1.3K
2.7K
From Lower Medium Tab
Pt. H31
See Dwg. 8
E17
Q33
From Lower Full Tab
Pt. H28
See Dwg. 8
E19
Q34
L.K. FLUTE VOLUME SWITCHERS
BOARD E
U/L FLUTE & STRING COLLECTORS

*Upper 4' & 8' and Lower 8' Flute Groups Are Common To String Groups Shown on Dwg. 6

Note: The Filter Designation appears on the printed circuit boards at the input of each filter.

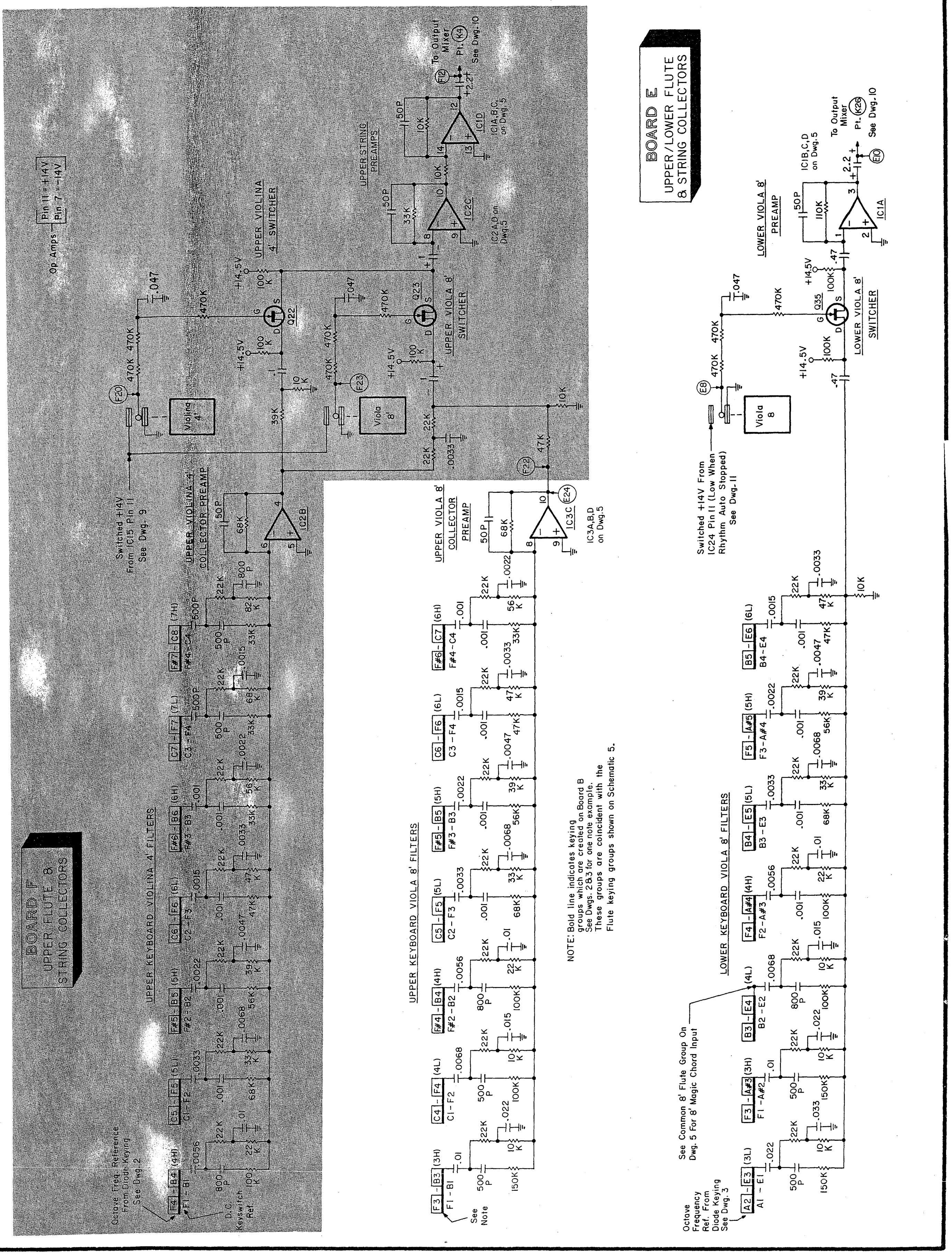
LOWER KEYBOARD FLUTE FILTER CHART

Footage	Keyboard Note	Octave Frequency	Filter	Filt. Des. See Note	C5	C6	C7	C8
8'	A1 - E1	A2-E3	Q14	3L	.082	.27	.0015	.082
	F1-A#2	F3-A#3	Q13	3H	.056	.22	.0012	.056
	B2-E2	B3-E4	Q12	4L	.039	.15	750P	.039
	F2-A#3	F4-A#4	Q11	4H	.027	.1	560P	.027
	B3-E3	B4-E5	Q10	5L	.022	.068	390P	.022
	F3-A#4	F5-A#5	Q9	5H	.015	.047	270P	.015
	B4-E4	B5-E6	Q8	6L	.01	.033	200P	.01

UPPER KEYBOARD FLUTE FILTER CHART

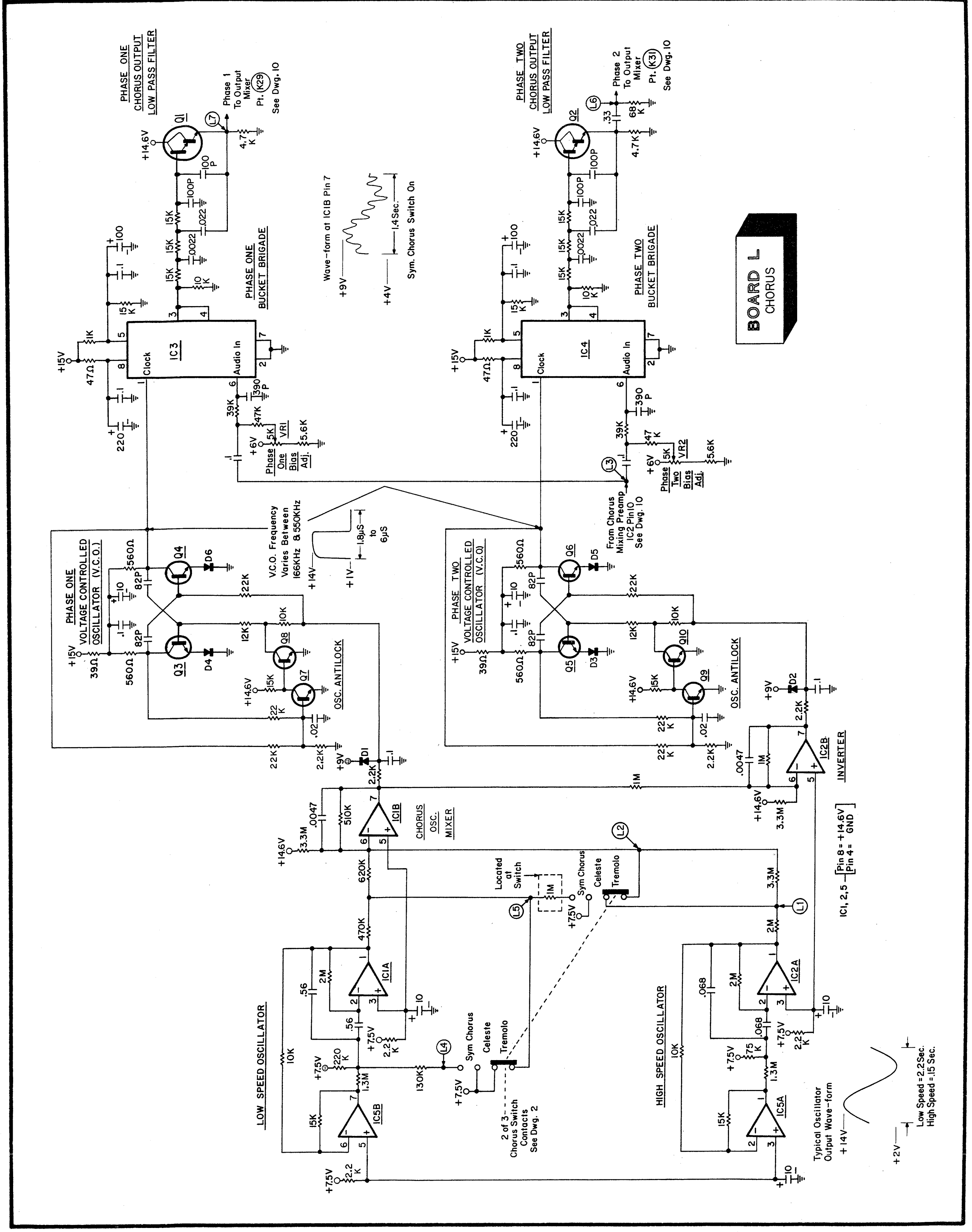
Footage	Keyboard Note	Octave Frequency	Filter	Filt. Des. See Note	C1	C2	C3	C4	Footage	Keyboard Note	Octave Frequency	Filter	Filt. Des. See Note	C1	C2	C3	C4
8'	F1 - B1	F3-B3	Q21	3H	.056	.18	.001	.047	16'	F1 - B1	F2 -B2	Q28	2H	.1	.39	.0022	.1
	C1-F2	C4-F4	Q20	4L	.039	.15	680P	.033		C1 -F2	C3-F3	Q27	3L	.082	.27	.0015	.068
	F#2-B2	F#4-B4	Q19	4H	.027	.1	510P	.022		F#2-B2	F#3-B3	Q26	3H	.056	.18	.001	.047
	C2-F3	C5-F5	Q18	5L	.018	.068	360P	.018		C2-F3	C4-F4	Q25	4L	.039	.15	680P	.033
	F#3-B3	F#5-B5	Q17	5H	.012	.047	270P	.012		F#3-B3	F#4-B4	Q24	4H	.027	.1	510P	.022
	C3-F4	C6-F6	Q16	6L	.01	.033	180P	.0068		C3-F4	C5-F5	Q23	5L	.018	.068	360P	.018
	F#4-C4	F#6-C7	Q15	6H	.0068	.022	120P	.0056		F#4-C4	F#5-C6	Q22	5H	.012	.047	240P	.012

6 UPPER & LOWER KEYBOARD STRING FILTERS


BOARD F
UPPER FLUTE & STRING COLLECTORS
BOARD E
UPPER/LOWER FLUTE & STRING COLLECTORS
Op Amps: Pin 11 = +14V, Pin 7 = -14V
UPPER KEYBOARD VIOLINA 4' FILTERS
UPPER VIOLINA 4' COLLECTOR PREAMP
UPPER VIOLINA 4' SWITCHER
UPPER VIOLA 8' SWITCHER
UPPER STRING PREAMPS
UPPER KEYBOARD VIOLA 8' FILTERS
UPPER VIOLA 8' COLLECTOR PREAMP
LOWER KEYBOARD VIOLA 8' FILTERS
LOWER VIOLA 8' SWITCHER
LOWER VIOLA 8' PREAMP
Octave Freq. Reference From Diode Keying See Dwg. 2
D.C. Keyswitch Ref.
Switched +14V From IC15 Pin 11 See Dwg. 9
Switched +14V From IC24 Pin 11 (Low When Rhythm Auto Stopped) See Dwg. 11
To Output Mixer Pt. K4 See Dwg. 10
To Output Mixer Pt. K26 See Dwg. 10
IC1A,B,C on Dwg.5
IC2A,B on Dwg.5
IC3A,B,D on Dwg.5
IC1B,C,D on Dwg.5
IC2B
IC2C
IC1D
IC3C
IC1A
Q22
Q23
Q35
F20
F23
F22
F12
E24
E8
E10
Violina 4'
Viola 8'
Viola 8
+14.5V
F4-B4 (4H) F1-B1 .0056
C6-F5 (5L) C1-F2 .0033
F#5-B5 (5H) F#2-B2 .0022
C6-F6 (6L) C2-F3 .0015
F#6-B6 (6H) F#3-B3 .001
C7-F7 (7L) C3-F4 500P
F#7-C8 (7H) F#4-C4 500P
F3-B3 (3H) F1-B1 .01
C4-F4 (4L) C1-F2 .0068
F#4-B4 (4H) F#2-B2 .0056
C5-F5 (5L) C2-F3 .0033
F#5-B5 (5H) F#3-B3 .0022
C6-F6 (6L) C3-F4 .0015
F#6-C7 (6H) F#4-C4 .001
A2-E3 (3L) A1-E1 .022
F3-A#3 (3H) F1-A#2 .01
B3-E4 (4L) B2-E2 .0068
F4-A#4 (4H) F2-A#3 .0056
B4-E5 (5L) B3-E3 .0033
F5-A#5 (5H) F3-A#4 .0022
B5-E6 (6L) B4-E4 .0015
See Note
Octave Frequency Ref. From Diode Keying See Dwg. 3
See Common 8' Flute Group On Dwg. 5 For 8' Magic Chord Input
NOTE: Bold line indicates keying groups which are created on Board B See Dwgs. 2&3 for one note example. These groups are coincident with the Flute keying groups shown on Schematic 5.

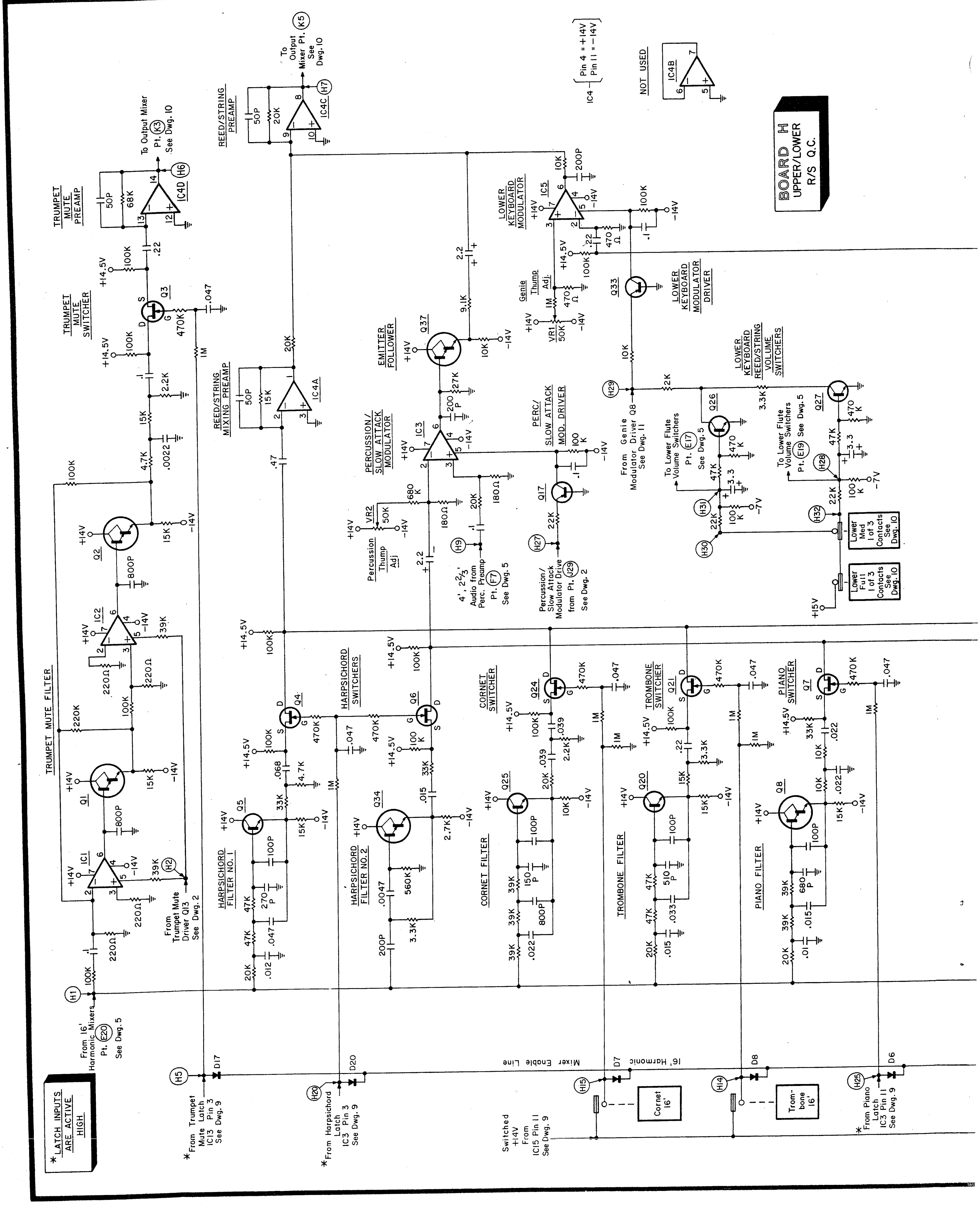
CHORUS MODULATOR

7


PHASE ONE CHORUS OUTPUT LOW PASS FILTER
PHASE TWO CHORUS OUTPUT LOW PASS FILTER
Phase 1 To Output Mixer Pt. (K29) See Dwg. 10
Phase 2 To Output Mixer Pt. (K31) See Dwg. 10
Q1
Q2
+14.6V
(L7)
(L6)
4.7 K
4.7K
68 K
.33
100 P
100P
15K
.0022
.022
10 K
+ 100
.1
15 K
1K
47Ω
+15V
220
PHASE ONE BUCKET BRIGADE
PHASE TWO BUCKET BRIGADE
IC3
IC4
Clock
Audio In
39K
47K
390 P
5K
VR1
VR2
5.6K
+6V
Phase One Bias Adj.
Phase Two Bias Adj.
(L3)
From Chorus Mixing Preamp IC2 Pin10 See Dwg. 10
Wave-form at IC1B Pin 7
+9V
+4V
1.4Sec.
Sym. Chorus Switch On
BOARD L
CHORUS
V.C.O. Frequency Varies Between 166KHz & 550KHz
+14V
+1V
1.8μS to 6μS
PHASE ONE VOLTAGE CONTROLLED OSCILLATOR (V.C.O.)
PHASE TWO VOLTAGE CONTROLLED OSCILLATOR (V.C.O)
39Ω
560Ω
82P
Q3
Q4
Q5
Q6
D3
D4
D5
D6
22K
12K
10K
Q7
Q8
Q9
Q10
OSC. ANTILOCK
+14.6V
15K
22 K
.02
2.2K
D1
D2
+9V
.0047
510K
3.3M
1M
IC1B
CHORUS OSC. MIXER
IC2B
INVERTER
IC1, 2, 5 — Pin 8 = +14.6V Pin 4 = GND
(L2)
620K
470K
3.3M
2M
(L1)
Located at Switch
(L5)
+7.5V
Sym Chorus
Celeste
Tremolo
IC1A
IC2A
.56
.068
2.2 K
220 K
75 K
1.3M
130K
(L4)
2 of 3-Chorus Switch Contacts See Dwg. 2
IC5A
IC5B
LOW SPEED OSCILLATOR
HIGH SPEED OSCILLATOR
Typical Oscillator Output Wave-form
+14V
+2V
Low Speed = 2.2Sec.
High Speed = .15 Sec.

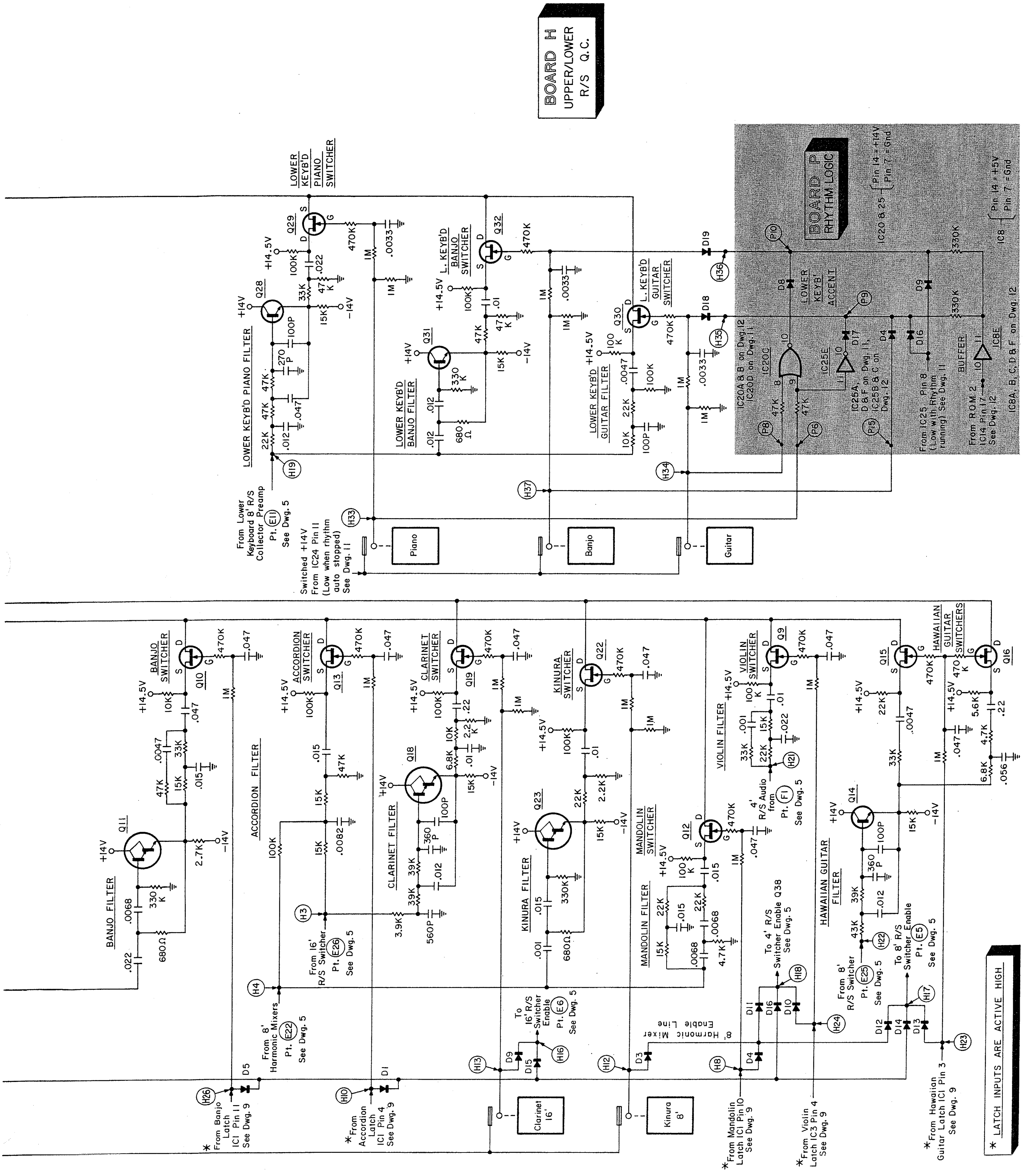
8

REED/STRING QUALITY CONTROL


TRUMPET MUTE PREAMP
IC4D
To Output Mixer Pt. K3 See Dwg. 10
TRUMPET MUTE SWITCHER
Q3
TRUMPET MUTE FILTER
IC1
IC2
Q1
Q2
From Trumpet Mute Driver Q13 See Dwg. 2
REED/STRING PREAMP
IC4C
To Output Mixer Pt. K5 See Dwg. 10
REED/STRING MIXING PREAMP
IC4A
EMITTER FOLLOWER
Q37
PERCUSSION/SLOW ATTACK MODULATOR
IC3
Percussion Thump Adj
VR2
4', 2 2/3' Audio from Perc. Preamp Pt. F7 See Dwg. 5
PERC/SLOW ATTACK MOD. DRIVER
Q17
Percussion/Slow Attack Modulator Drive from Pt. J29 See Dwg. 2
LOWER KEYBOARD MODULATOR
IC5
Genie Thump Adj.
VR1
LOWER KEYBOARD MODULATOR DRIVER
Q33
IC4 – Pin 4 = +14V, Pin 11 = −14V
NOT USED
IC4B
BOARD H
UPPER/LOWER R/S Q.C.
LOWER KEYBOARD REED/STRING VOLUME SWITCHERS
Q26
Q27
From Genie Modulator Driver Q8 See Dwg. 11
To Lower Flute Volume Switchers Pt. E17 See Dwg. 5
To Lower Flute Volume Switchers Pt. E19 See Dwg. 5
Lower Med 1 of 3 Contacts See Dwg. 10
Lower Full 1 of 3 Contacts See Dwg. 10
HARPSICHORD SWITCHERS
Q4
Q6
HARPSICHORD FILTER NO. 1
Q5
HARPSICHORD FILTER NO. 2
Q34
CORNET SWITCHER
Q24
CORNET FILTER
Q25
TROMBONE SWITCHER
Q21
TROMBONE FILTER
Q20
PIANO SWITCHER
Q7
PIANO FILTER
Q8
From 16' Harmonic Mixers Pt. E20 See Dwg. 5
16' Harmonic Mixer Enable Line
D17
D20
D7
D8
D6
Cornet 16'
Trom-bone 16'
*From Trumpet Mute Latch IC13 Pin 3 See Dwg. 9
*From Harpsichord Latch IC3 Pin 3 See Dwg. 9
Switched +14V From IC15 Pin 11 See Dwg. 9
*From Piano Latch IC3 Pin 11 See Dwg. 9
*LATCH INPUTS ARE ACTIVE HIGH
H1
H2
H5
H6
H7
H9
H14
H15
H20
H25
H27
H28
H29
H30
H31
H32
+14V
−14V
+14.5V
+15V
−7V

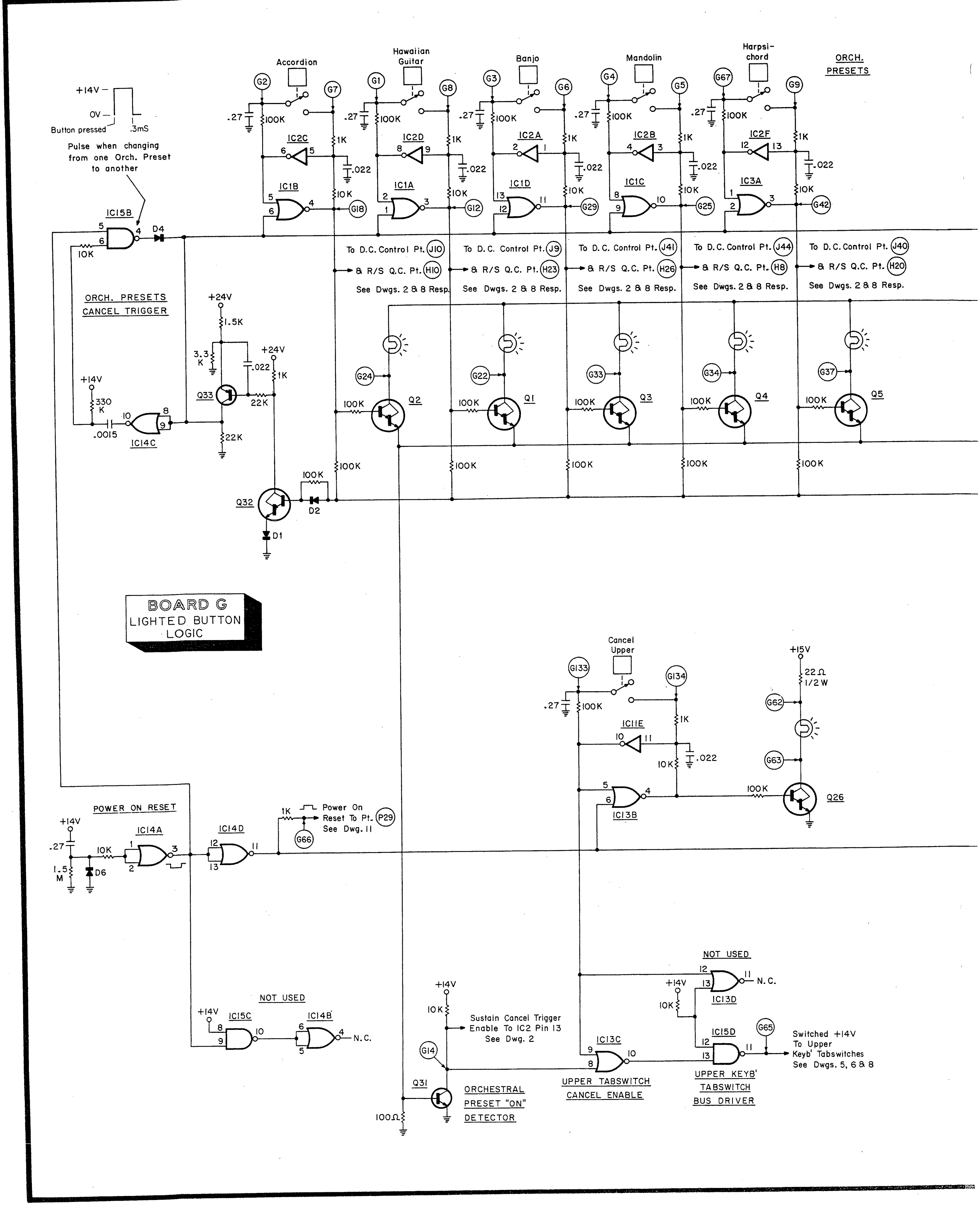
REED/STRING QUALITY CONTROL

8


BOARD H
UPPER/LOWER
R/S Q.C.
BOARD P
RHYTHM LOGIC
LOWER KEYB'D PIANO SWITCHER
LOWER KEYB'D PIANO FILTER
L. KEYB'D BANJO SWITCHER
LOWER KEYB'D BANJO FILTER
L. KEYB'D GUITAR SWITCHER
LOWER KEYB'D GUITAR FILTER
LOWER KEYB' ACCENT
BUFFER
IC20 & 25 Pin 14 = +14V Pin 7 = Gnd
IC8 Pin 14 = +5V Pin 7 = Gnd
IC20A & B on Dwg. 12 IC20D on Dwg. 11
IC25A, D & F on Dwg. 11, IC25B & C on Dwg. 12
IC8A, B, C, D & F on Dwg. 12
From IC25 Pin 8 (Low with Rhythm running) See Dwg. 11
From R.O.M. 2 IC14 Pin 17 See Dwg. 12
From Lower Keyboard 8' R/S Collector Preamp Pt. E11 See Dwg. 5
Switched +14V From IC24 Pin 11 (Low when rhythm auto stopped) See Dwg. 11
Piano
Banjo
Guitar
BANJO SWITCHER
BANJO FILTER
ACCORDION SWITCHER
ACCORDION FILTER
CLARINET SWITCHER
CLARINET FILTER
KINURA SWITCHER
KINURA FILTER
MANDOLIN SWITCHER
MANDOLIN FILTER
VIOLIN SWITCHER
VIOLIN FILTER
HAWAIIAN GUITAR SWITCHERS
HAWAIIAN GUITAR FILTER
From 16' R/S Switcher Pt. E26 See Dwg. 5
From 8' Harmonic Mixers Pt. E22 See Dwg. 5
To 16' R/S Switcher Enable Pt. E6 See Dwg. 5
8' Harmonic Mixer Enable Line
4' R/S Audio from Pt. F1 See Dwg. 5
To 4' R/S Switcher Enable Q38 See Dwg. 5
From 8' R/S Switcher Pt. E25 See Dwg. 5
To 8' R/S Switcher Enable Pt. E5 See Dwg. 5
*From Banjo Latch IC1 Pin 11 See Dwg. 9
*From Accordion Latch IC1 Pin 4 See Dwg. 9
Clarinet 16'
Kinura 8'
*From Mandolin Latch IC1 Pin 10 See Dwg. 9
*From Violin Latch IC3 Pin 4 See Dwg. 9
*From Hawaiian Guitar Latch IC1 Pin 3 See Dwg. 9
* LATCH INPUTS ARE ACTIVE HIGH

9

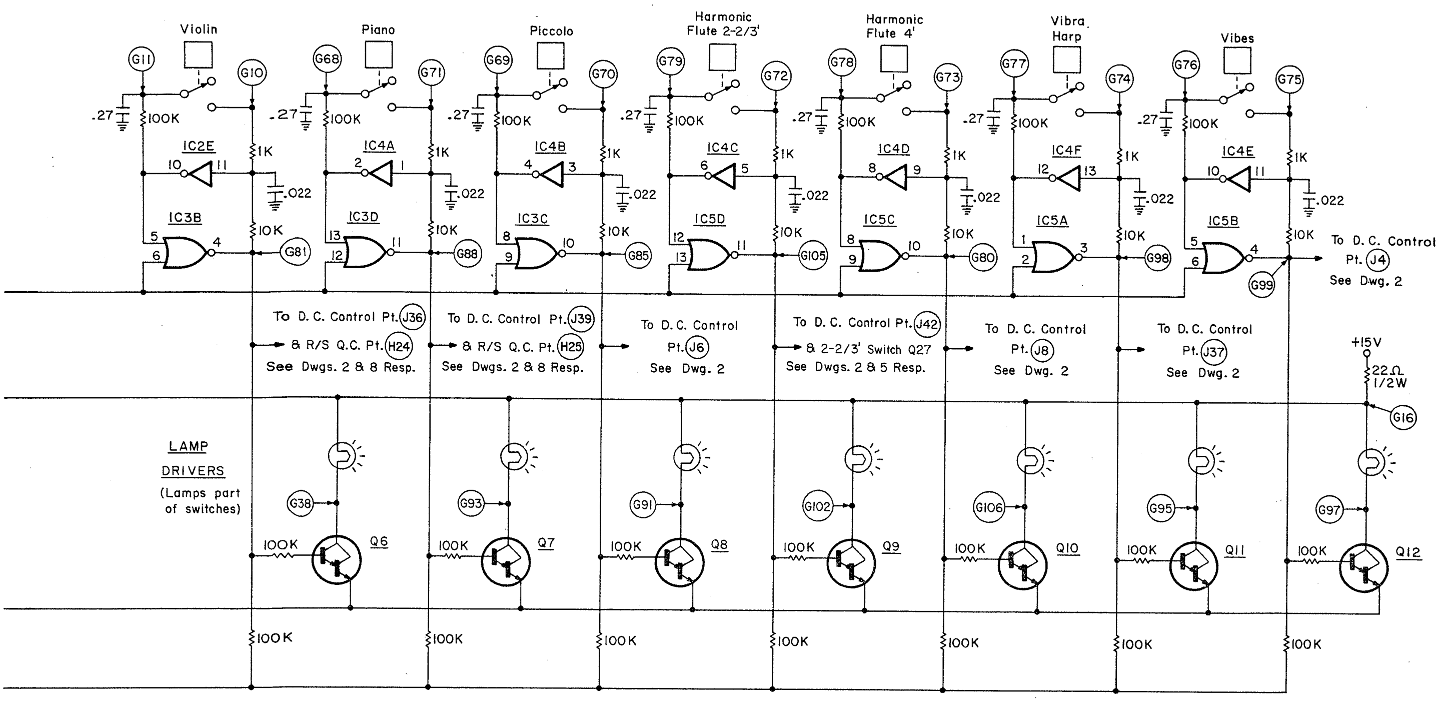
LIGHTED BUTTON LOGIC



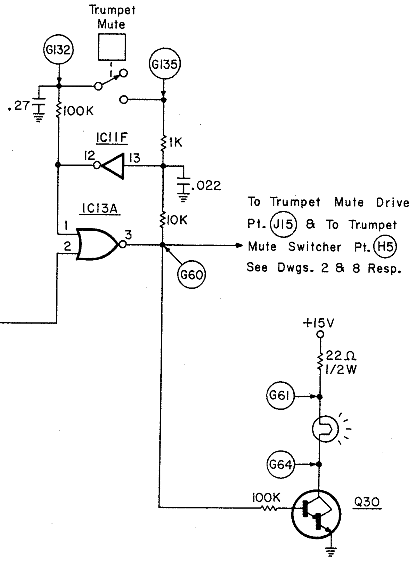
ORCH. PRESETS
Accordion
Hawaiian Guitar
Banjo
Mandolin
Harpsi- chord
+14V
0V
Button pressed
.3mS
Pulse when changing from one Orch. Preset to another
IC15B
D4
10K
ORCH. PRESETS CANCEL TRIGGER
G2
G7
G1
G8
G3
G6
G4
G5
G67
G9
.27
100K
1K
.022
10K
IC2C
IC2D
IC2A
IC2B
IC2F
IC1B
IC1A
IC1D
IC1C
IC3A
G18
G12
G29
G25
G42
To D.C. Control Pt. J10
& R/S Q.C. Pt. H10
See Dwgs. 2 & 8 Resp.
To D.C. Control Pt. J9
& R/S Q.C. Pt. H23
To D.C. Control Pt. J41
& R/S Q.C. Pt. H26
To D.C. Control Pt. J44
& R/S Q.C. Pt. H8
To D.C. Control Pt. J40
& R/S Q.C. Pt. H20
+24V
1.5K
3.3 K
Q33
22K
330 K
.0015
IC14C
G24
G22
G33
G34
G37
Q2
Q1
Q3
Q4
Q5
Q32
D2
D1
BOARD G
LIGHTED BUTTON LOGIC
Cancel Upper
G133
G134
IC11E
IC13B
+15V
22Ω 1/2W
G62
G63
Q26
POWER ON RESET
IC14A
IC14D
.27
1.5 M
D6
Power On Reset To Pt. P29
See Dwg. 11
G66
NOT USED
IC15C
IC14B
N.C.
+14V
Sustain Cancel Trigger Enable To IC2 Pin 13
See Dwg. 2
G14
Q31
100Ω
ORCHESTRAL PRESET "ON" DETECTOR
IC13C
UPPER TABSWITCH CANCEL ENABLE
NOT USED
IC13D
IC15D
G65
Switched +14V To Upper Keyb' Tabswitches
See Dwgs. 5, 6 & 8
UPPER KEYB' TABSWITCH BUS DRIVER

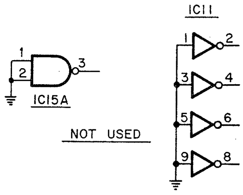
LIGHTED BUTTON LOGIC

9


Violin
Piano
Piccolo
Harmonic Flute 2-2/3'
Harmonic Flute 4'
Vibra Harp
Vibes
G11
G10
G68
G71
G69
G70
G79
G72
G78
G73
G77
G74
G76
G75
.27
100K
1K
.022
10K
IC2E
IC4A
IC4B
IC4C
IC4D
IC4F
IC4E
IC3B
IC3D
IC3C
IC5D
IC5C
IC5A
IC5B
G81
G88
G85
G105
G80
G98
G99
To D. C. Control Pt. J4 See Dwg. 2
To D. C. Control Pt. J36 & R/S Q.C. Pt. H24 See Dwgs. 2 & 8 Resp.
To D. C. Control Pt. J39 & R/S Q.C. Pt. H25 See Dwgs. 2 & 8 Resp.
To D. C. Control Pt. J6 See Dwg. 2
To D. C. Control Pt. J42 & 2-2/3' Switch Q27 See Dwgs. 2 & 5 Resp.
To D. C. Control Pt. J8 See Dwg. 2
To D. C. Control Pt. J37 See Dwg. 2
+15V
22Ω 1/2W
G16
LAMP DRIVERS
(Lamps part of switches)
G38
G93
G91
G102
G106
G95
G97
100K
Q6
Q7
Q8
Q9
Q10
Q11
Q12

All IC's Unless Otherwise Specified — Pin 14 = +14V, Pin 1 = GND

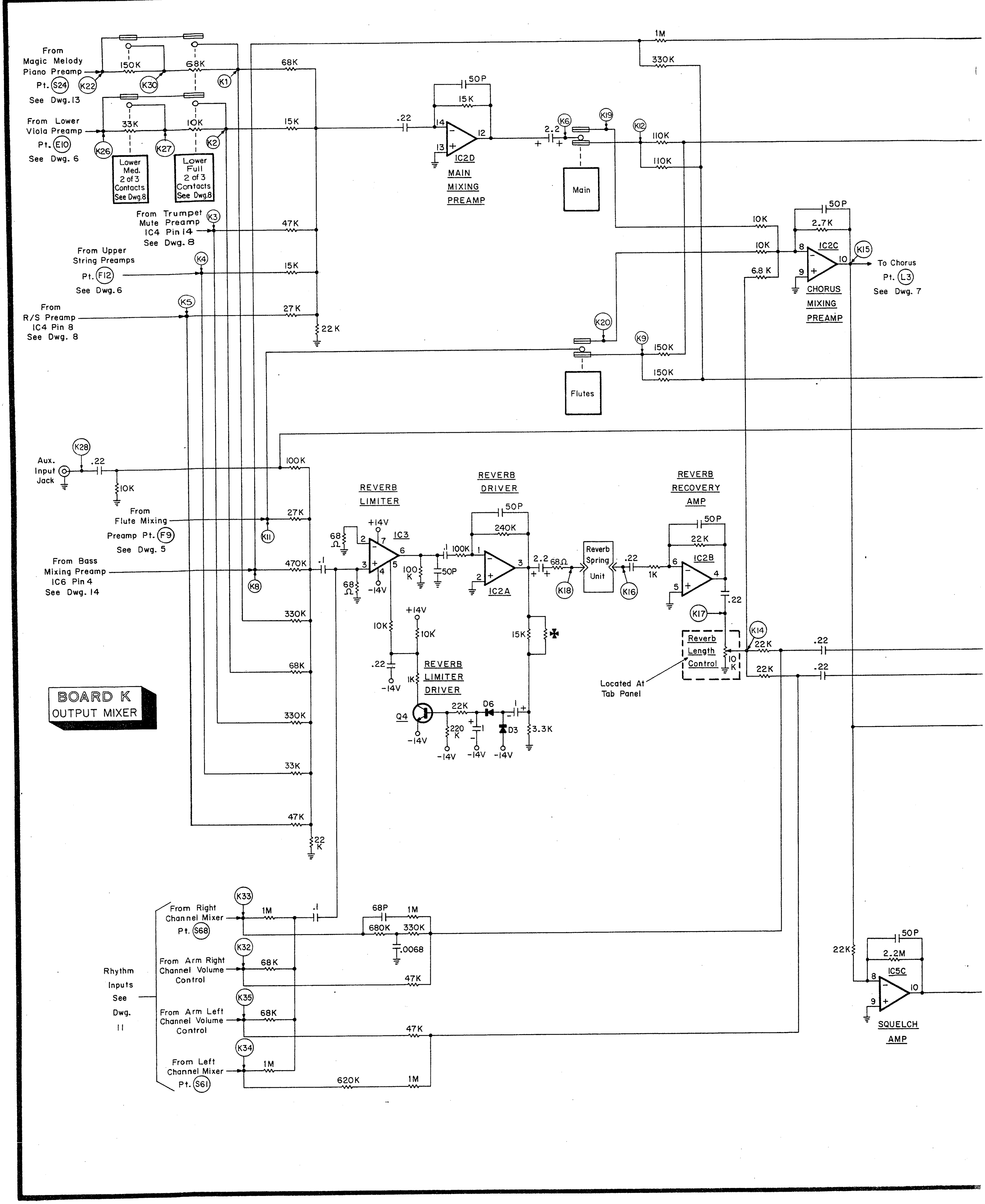

Trumpet Mute
G132
G135
.27
100K
IC11F
12
13
1K
.022
IC13A
10K
G60
To Trumpet Mute Drive Pt. J15 & To Trumpet Mute Switcher Pt. H5 See Dwgs. 2 & 8 Resp.
+15V
22Ω 1/2W
G61
G64
100K
Q30


IC11
1
2
3
4
5
6
9
8
IC15A
NOT USED

BOARD G
LIGHTED BUTTON LOGIC

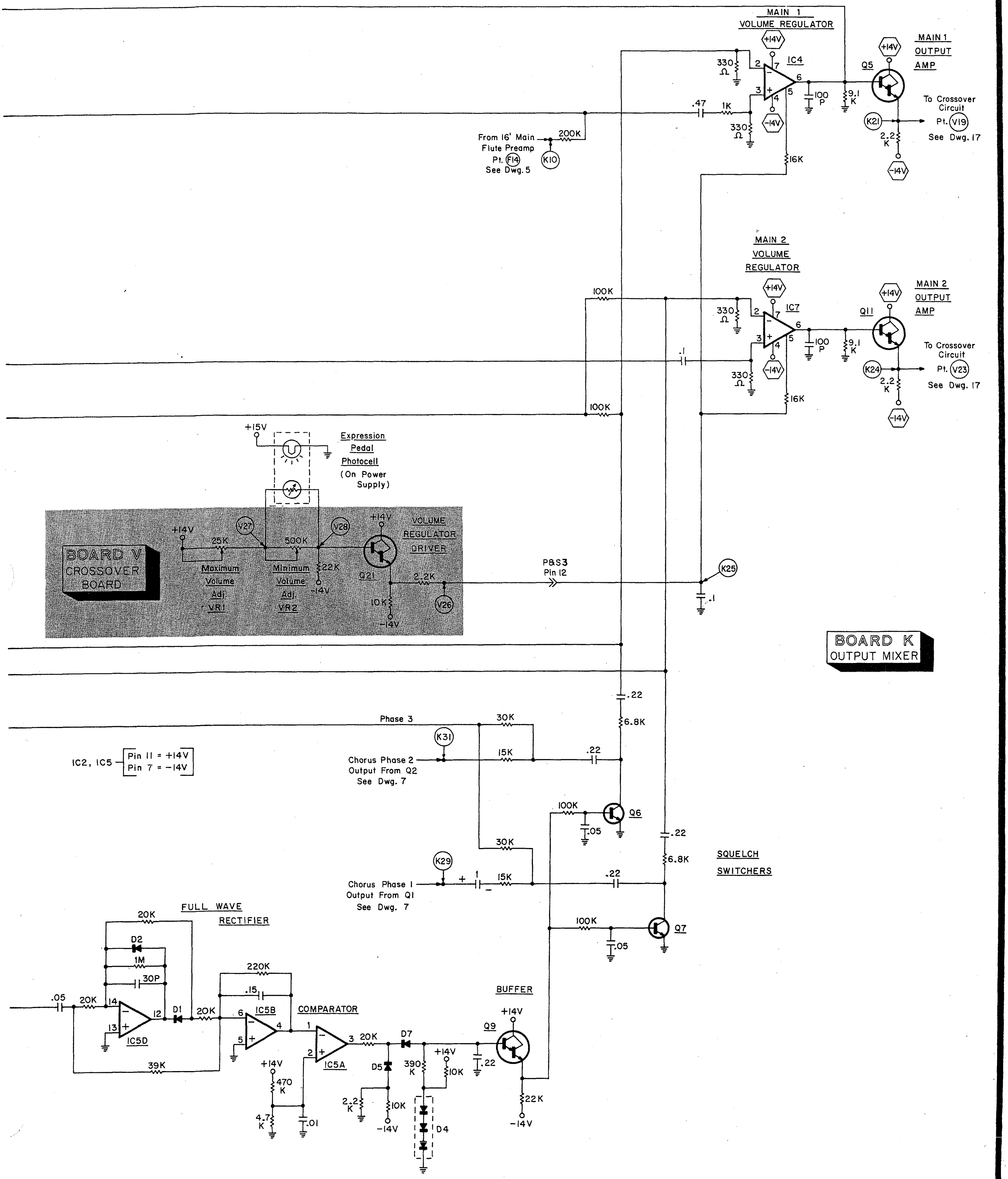
10

OUTPUT MIXER


From Magic Melody Piano Preamp Pt. S24 See Dwg. 13
K22
K30
K1
150K
68K
68K
1M
330K
From Lower Viola Preamp Pt. E10 See Dwg. 6
33K
10K
15K
K26
K27
K2
Lower Med. 2 of 3 Contacts See Dwg. 8
Lower Full 2 of 3 Contacts See Dwg. 8
.22
50P
15K
14
13
12
IC2D
MAIN MIXING PREAMP
2.2
K6
K19
K12
110K
110K
Main
From Trumpet Mute Preamp IC4 Pin 14 See Dwg. 8
K3
47K
From Upper String Preamps Pt. F12 See Dwg. 6
K4
15K
From R/S Preamp IC4 Pin 8 See Dwg. 8
K5
27K
22K
10K
10K
6.8K
50P
2.7K
8
9
10
IC2C
CHORUS MIXING PREAMP
K15
To Chorus Pt. L3 See Dwg. 7
K20
K9
150K
150K
Flutes
K28
Aux. Input Jack
.22
10K
100K
From Flute Mixing Preamp Pt. F9 See Dwg. 5
27K
K11
From Bass Mixing Preamp IC6 Pin 4 See Dwg. 14
K8
470K
.1
REVERB LIMITER
+14V
68 Ω
68 Ω
IC3
2
3
4
5
6
7
-14V
100 K
50P
.1
100K
REVERB DRIVER
50P
240K
1
2
3
IC2A
2.2
68Ω
K18
Reverb Spring Unit
K16
.22
1K
REVERB RECOVERY AMP
50P
22K
6
5
4
IC2B
.22
K17
Reverb Length Control
10 K
Located At Tab Panel
K14
22K
22K
.22
.22
+14V
10K
10K
.22
-14V
1K
REVERB LIMITER DRIVER
Q4
-14V
22K
D6
220 K
1
D3
-14V
-14V
-14V
15K
✠
3.3K
1
330K
68K
330K
33K
47K
22 K
BOARD K
OUTPUT MIXER
K33
From Right Channel Mixer Pt. S68
1M
.1
68P
1M
680K
330K
.0068
K32
From Arm Right Channel Volume Control
68K
47K
Rhythm Inputs See Dwg. 11
K35
From Arm Left Channel Volume Control
68K
47K
K34
From Left Channel Mixer Pt. S61
1M
620K
1M
22K
50P
2.2M
IC5C
8
9
10
SQUELCH AMP

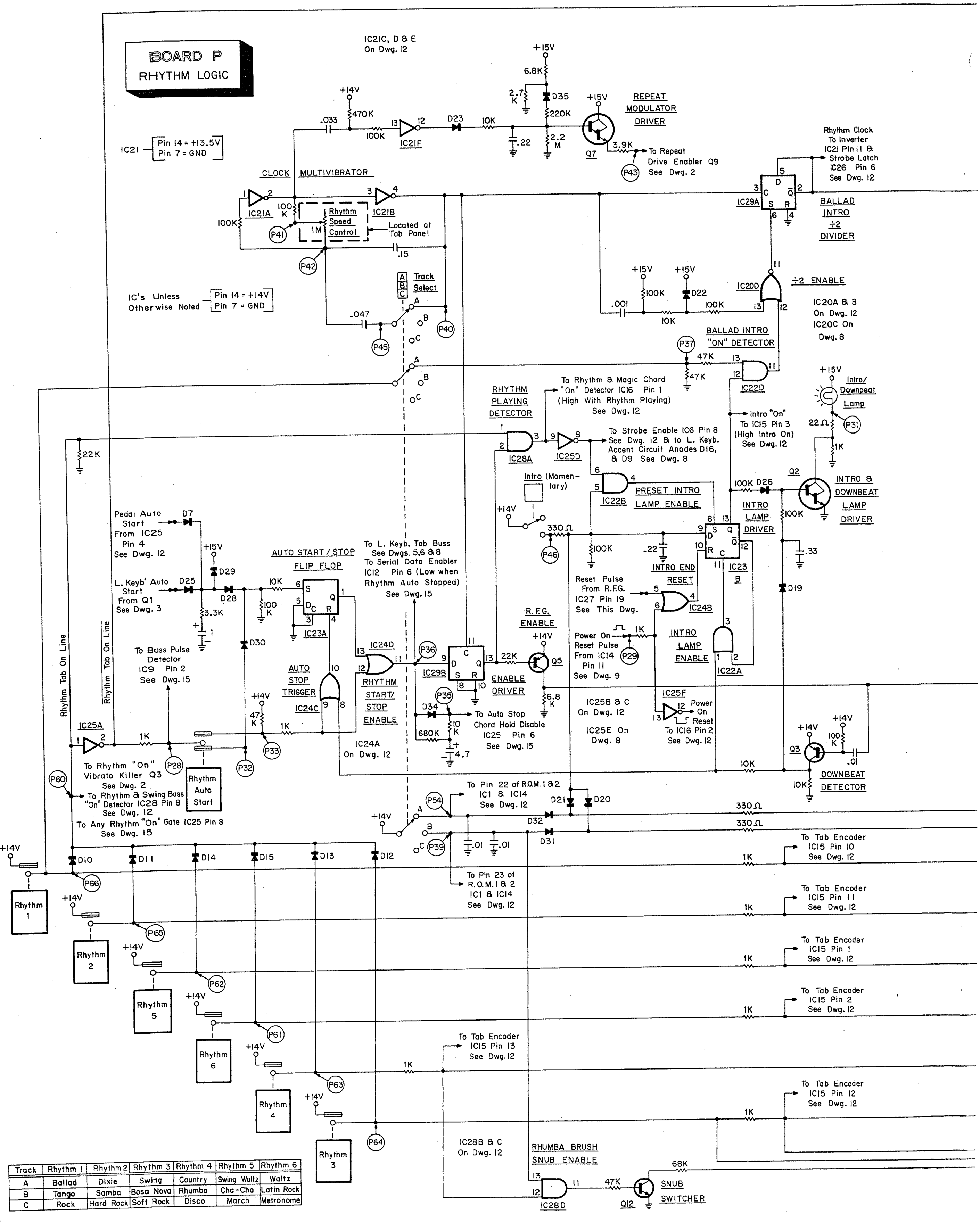
OUTPUT MIXER

10


MAIN 1 VOLUME REGULATOR
+14V
IC4
330 Ω
330 Ω
.47
1K
-14V
100 P
9.1 K
16K
MAIN 1 OUTPUT AMP
Q5
+14V
K21
2.2 K
-14V
To Crossover Circuit Pt. V19 See Dwg. 17
From 16' Main Flute Preamp Pt. F14 See Dwg. 5
200K
K10
MAIN 2 VOLUME REGULATOR
+14V
IC7
330 Ω
330 Ω
.1
-14V
100 P
9.1 K
16K
MAIN 2 OUTPUT AMP
Q11
+14V
K24
2.2 K
-14V
To Crossover Circuit Pt. V23 See Dwg. 17
100K
100K
+15V
Expression Pedal Photocell (On Power Supply)
BOARD V CROSSOVER BOARD
+14V
25K
Maximum Volume Adj. VR1
V27
500K
Minimum Volume Adj. VR2
V28
22K
-14V
+14V
Q21
VOLUME REGULATOR DRIVER
2.2K
10K
-14V
V26
P&S3 Pin 12
K25
.1
BOARD K OUTPUT MIXER
.22
6.8K
Phase 3
30K
K31
Chorus Phase 2 Output From Q2 See Dwg. 7
15K
.22
IC2, IC5 Pin 11 = +14V Pin 7 = -14V
100K
.05
Q6
.22
6.8K
SQUELCH SWITCHERS
30K
K29
Chorus Phase 1 Output From Q1 See Dwg. 7
+
1
15K
.22
100K
.05
Q7
FULL WAVE RECTIFIER
20K
D2
1M
30P
.05
20K
IC5D
D1
20K
39K
220K
.15
IC5B
COMPARATOR
IC5A
+14V
470 K
4.7 K
.01
20K
D7
D5
2.2 K
10K
-14V
390 K
+14V
10K
D4
BUFFER
+14V
Q9
.22
22K
-14V

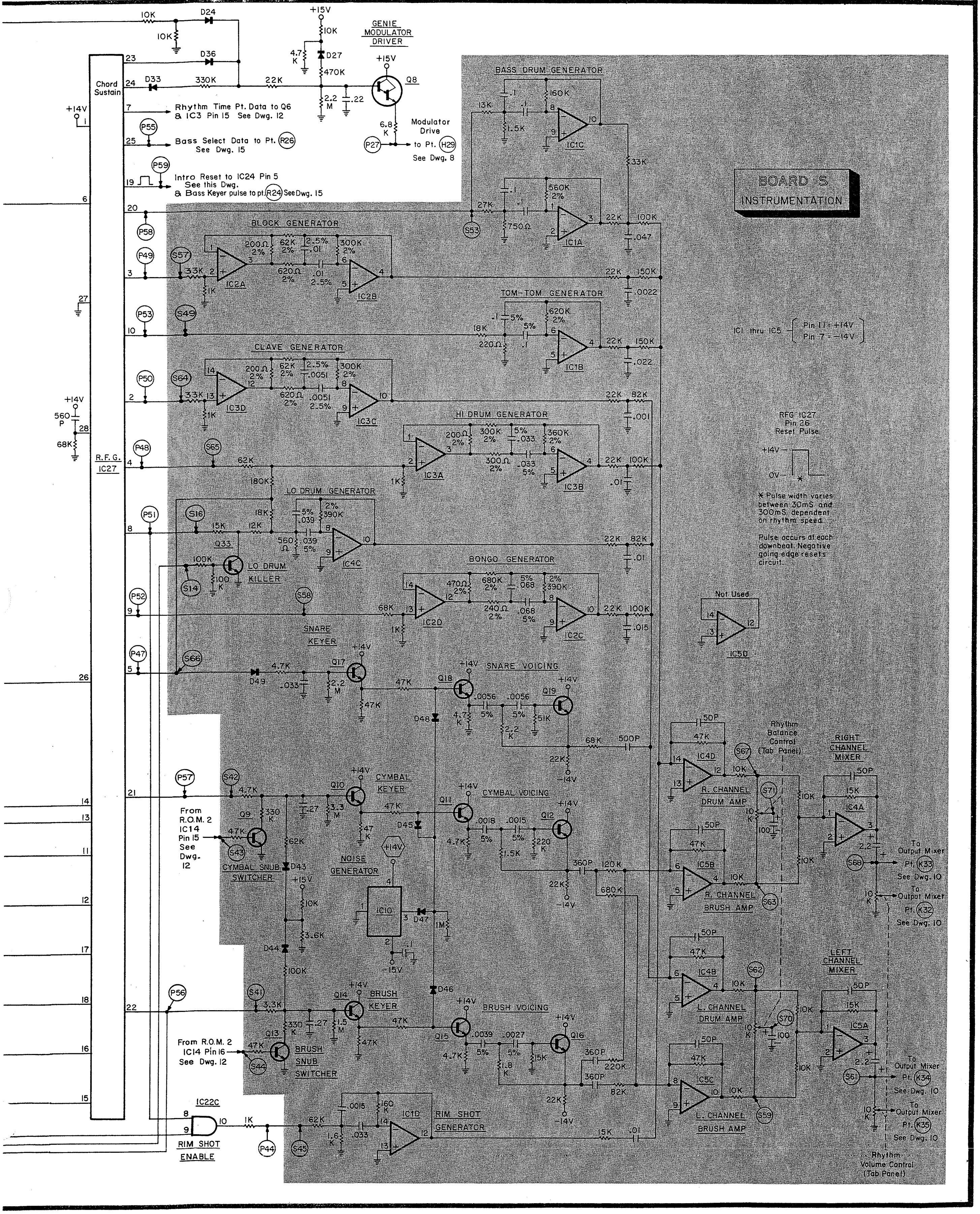
11

RHYTHM


BOARD P
RHYTHM LOGIC
IC21C, D & E On Dwg. 12
IC21 Pin 14 = +13.5V Pin 7 = GND
+14V
470K
.033
100K
13
12
IC21F
D23
10K
+15V
6.8K
2.7 K
D35
220K
.22
2.2 M
+15V
Q7
3.9K
REPEAT MODULATOR DRIVER
To Repeat Drive Enabler Q9 See Dwg. 2
P43
Rhythm Clock To Inverter IC21 Pin 11 & Strobe Latch IC26 Pin 6 See Dwg. 12
CLOCK MULTIVIBRATOR
IC21A
IC21B
100 K
100K
Rhythm Speed Control
1M
Located at Tab Panel
P41
P42
.15
IC29A
BALLAD INTRO ÷2 DIVIDER
IC's Unless Otherwise Noted Pin 14 = +14V Pin 7 = GND
Track Select
A B C
.047
P45
P40
+15V
+15V
100K
D22
.001
10K
100K
IC20D
÷2 ENABLE
IC20A & B On Dwg. 12 IC20C On Dwg. 8
BALLAD INTRO "ON" DETECTOR
P37
47K
47K
IC22D
+15V
Intro/ Downbeat Lamp
22Ω
P31
1K
RHYTHM PLAYING DETECTOR
To Rhythm & Magic Chord "On" Detector IC16 Pin 1 (High With Rhythm Playing) See Dwg. 12
Intro "On" To IC15 Pin 3 (High Intro On) See Dwg. 12
22K
IC28A
IC25D
To Strobe Enable IC6 Pin 8 See Dwg. 12 & to L. Keyb. Accent Circuit Anodes D16, & D9 See Dwg. 8
Intro (Momentary)
IC22B
PRESET INTRO LAMP ENABLE
100K D26
Q2
INTRO & DOWNBEAT LAMP DRIVER
INTRO LAMP DRIVER
100K
+14V
330Ω
P46
100K
.22
INTRO END RESET
IC23 B
.33
D19
Pedal Auto Start From IC25 Pin 4 See Dwg. 12
D7
+15V
D29
L. Keyb' Auto Start From Q1 See Dwg. 3
D25
D28
3.3K
10K
100 K
AUTO START / STOP FLIP FLOP
IC23A
To L. Keyb. Tab Buss See Dwgs. 5,6 & 8 To Serial Data Enabler IC12 Pin 6 (Low when Rhythm Auto Stopped) See Dwg. 15
Reset Pulse From R.F.G. IC27 Pin 19 See This Dwg.
IC24B
R.F.G. ENABLE
+14V
22K
Q5
ENABLE DRIVER
IC29B
P36
IC24D
Power On Reset Pulse From IC14 Pin 11 See Dwg. 9
1K
P29
INTRO LAMP ENABLE
IC22A
Rhythm Tab On Line
D30
To Bass Pulse Detector IC9 Pin 2 See Dwg. 15
AUTO STOP TRIGGER
IC24C
RHYTHM START/ STOP ENABLE
P35
D34
To Auto Stop Chord Hold Disable IC25 Pin 6 See Dwg. 15
680K
10 K
4.7
6.8 K
IC25B & C On Dwg. 12
IC25E On Dwg. 8
IC25F
Power On Reset To IC16 Pin 2 See Dwg. 12
+14V
100 K
Q3
.01
DOWNBEAT DETECTOR
10K
10K
+14V
47 K
1K
IC25A
1K
P33
P32
P28
To Rhythm "On" Vibrato Killer Q3 See Dwg. 2
Rhythm Auto Start
P60
To Rhythm & Swing Bass "On" Detector IC28 Pin 8 See Dwg. 12
To Any Rhythm "On" Gate IC25 Pin 8 See Dwg. 15
IC24A On Dwg. 12
To Pin 22 of R.O.M. 1 & 2 IC1 & IC14 See Dwg. 12
P54
D21
D20
D32
D31
330Ω
330Ω
P39
.01
.01
To Pin 23 of R.O.M. 1 & 2 IC1 & IC14 See Dwg. 12
D10
D11
D14
D15
D13
D12
P66
Rhythm 1
Rhythm 2
P65
Rhythm 5
P62
Rhythm 6
P61
Rhythm 4
P63
Rhythm 3
P64
+14V
To Tab Encoder IC15 Pin 10 See Dwg. 12
To Tab Encoder IC15 Pin 11 See Dwg. 12
To Tab Encoder IC15 Pin 1 See Dwg. 12
To Tab Encoder IC15 Pin 2 See Dwg. 12
To Tab Encoder IC15 Pin 13 See Dwg. 12
To Tab Encoder IC15 Pin 12 See Dwg. 12
1K
IC28B & C On Dwg. 12
RHUMBA BRUSH SNUB ENABLE
IC28D
47K
68K
Q12
SNUB SWITCHER

Track	Rhythm 1	Rhythm 2	Rhythm 3	Rhythm 4	Rhythm 5	Rhythm 6
A	Ballad	Dixie	Swing	Country	Swing Waltz	Waltz
B	Tango	Samba	Bosa Nova	Rhumba	Cha-Cha	Latin Rock
C	Rock	Hard Rock	Soft Rock	Disco	March	Metronome

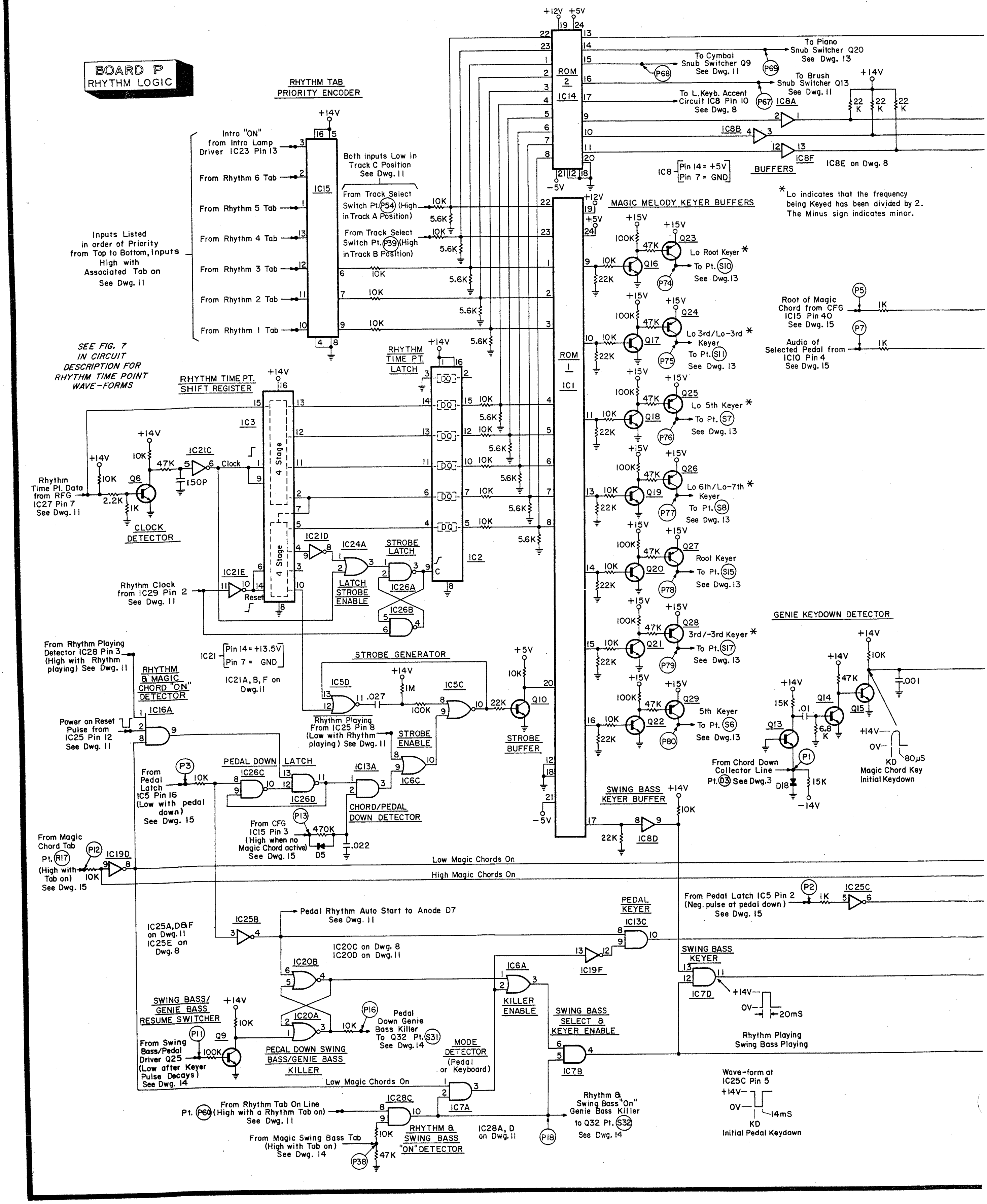
RHYTHM



Chord Sustain
R.F.G. IC27
Rhythm Time Pt. Data to Q6 & IC3 Pin 15 See Dwg. 12
Bass Select Data to Pt. R26 See Dwg. 15
Intro Reset to IC24 Pin 5 See this Dwg. & Bass Keyer pulse to pt. R24 See Dwg. 15
GENIE MODULATOR DRIVER
Modulator Drive to Pt. H29 See Dwg. 8
BASS DRUM GENERATOR
BOARD S INSTRUMENTATION
BLOCK GENERATOR
TOM-TOM GENERATOR
CLAVE GENERATOR
HI DRUM GENERATOR
LO DRUM GENERATOR
LO DRUM KILLER
BONGO GENERATOR
IC1 thru IC5 Pin 11 = +14V Pin 7 = -14V
RFG IC27 Pin 26 Reset Pulse
* Pulse width varies between 30mS and 300mS dependent on rhythm speed.
Pulse occurs at each downbeat. Negative going edge resets circuit.
Not Used
IC5D
SNARE KEYER
SNARE VOICING
CYMBAL KEYER
CYMBAL VOICING
CYMBAL SNUB SWITCHER
From R.O.M. 2 IC14 Pin 15 See Dwg. 12
NOISE GENERATOR
BRUSH KEYER
BRUSH VOICING
BRUSH SNUB SWITCHER
From R.O.M. 2 IC14 Pin 16 See Dwg. 12
IC22C
RIM SHOT ENABLE
RIM SHOT GENERATOR
Rhythm Balance Control (Tab Panel)
RIGHT CHANNEL MIXER
R. CHANNEL DRUM AMP
R. CHANNEL BRUSH AMP
LEFT CHANNEL MIXER
L. CHANNEL DRUM AMP
L. CHANNEL BRUSH AMP
To Output Mixer Pt. K33 See Dwg. 10
To Output Mixer Pt. K32 See Dwg. 10
To Output Mixer Pt. K34 See Dwg. 10
To Output Mixer Pt. K35 See Dwg. 10
Rhythm Volume Control (Tab Panel)

12

MAGIC MELODY & SWING BASS LOGIC



BOARD P
RHYTHM LOGIC
RHYTHM TAB PRIORITY ENCODER
+14V
Intro "ON" from Intro Lamp Driver IC23 Pin 13
From Rhythm 6 Tab
From Rhythm 5 Tab
From Rhythm 4 Tab
From Rhythm 3 Tab
From Rhythm 2 Tab
From Rhythm 1 Tab
Inputs Listed in order of Priority from Top to Bottom, Inputs High with Associated Tab on See Dwg. 11
IC15
Both Inputs Low in Track C Position See Dwg. 11
From Track Select Switch Pt. P54 (High in Track A Position)
From Track Select Switch Pt. P39 (High in Track B Position)
10K
5.6K
+12V +5V
ROM 2 IC14
-5V
To Piano Snub Switcher Q20 See Dwg. 13
To Cymbal Snub Switcher Q9 See Dwg. 11
P68
P69
To Brush Snub Switcher Q13 See Dwg. 11
To L.Keyb. Accent Circuit IC8 Pin 10 See Dwg. 8
P67
IC8A
IC8B
IC8F
IC8E on Dwg. 8
BUFFERS
IC8 Pin 14 = +5V Pin 7 = GND
+14V
22K
*Lo indicates that the frequency being Keyed has been divided by 2. The Minus sign indicates minor.
MAGIC MELODY KEYER BUFFERS
+15V
100K
47K
Q23
Q16
Lo Root Keyer *
To Pt. S10
P74
See Dwg. 13
Q24
Q17
Lo 3rd/Lo-3rd * Keyer
To Pt. S11
P75
See Dwg. 13
Q25
Q18
Lo 5th Keyer *
To Pt. S7
P76
See Dwg. 13
Q26
Q19
Lo 6th/Lo-7th * Keyer
To Pt. S8
P77
See Dwg. 13
Q27
Q20
Root Keyer
To Pt. S15
P78
See Dwg. 13
Q28
Q21
3rd/-3rd Keyer *
To Pt. S17
P79
See Dwg. 13
Q29
Q22
5th Keyer
To Pt. S6
P80
See Dwg. 13
Root of Magic Chord from CFG IC15 Pin 40 See Dwg. 15
P5
1K
Audio of Selected Pedal from IC10 Pin 4 See Dwg. 15
P7
ROM 1 IC1
SEE FIG. 7 IN CIRCUIT DESCRIPTION FOR RHYTHM TIME POINT WAVE-FORMS
RHYTHM TIME PT. SHIFT REGISTER
RHYTHM TIME PT. LATCH
IC3
4 Stage
IC2
DQ
Rhythm Time Pt. Data from RFG IC27 Pin 7 See Dwg. 11
Q6
2.2K
1K
CLOCK DETECTOR
IC21C
150P
Clock
Rhythm Clock from IC29 Pin 2 See Dwg. 11
IC21E
Reset
IC21D
IC24A
STROBE LATCH
IC26A
IC26B
LATCH STROBE ENABLE
IC21 Pin 14 = +13.5V Pin 7 = GND
IC21A, B, F on Dwg. 11
From Rhythm Playing Detector IC28 Pin 3 (High with Rhythm playing) See Dwg. 11
RHYTHM & MAGIC CHORD "ON" DETECTOR
IC16A
Power on Reset Pulse from IC25 Pin 12 See Dwg. 11
STROBE GENERATOR
IC5D
IC5C
1M
.027
100K
Rhythm Playing From IC25 Pin 8 (Low with Rhythm playing) See Dwg. 11
STROBE ENABLE
+5V
Q10
STROBE BUFFER
PEDAL DOWN LATCH
IC26C
IC26D
IC13A
IC6C
From Pedal Latch IC5 Pin 16 (Low with pedal down) See Dwg. 15
P3
CHORD/PEDAL DOWN DETECTOR
From CFG IC15 Pin 3 (High when no Magic Chord active) See Dwg. 15
P13
470K
D5
.022
SWING BASS KEYER BUFFER
IC8D
GENIE KEYDOWN DETECTOR
Q13
Q14
Q15
15K
.01
6.8K
.001
80μS
KD
Magic Chord Key Initial Keydown
From Chord Down Collector Line Pt. D3 See Dwg. 3
P1
D18
-14V
From Magic Chord Tab Pt. R17 (High with Tab on) See Dwg. 15
P12
IC19D
Low Magic Chords On
High Magic Chords On
PEDAL KEYER
IC13C
From Pedal Latch IC5 Pin 2 (Neg. pulse at pedal down) See Dwg. 15
P2
IC25C
IC25A, D & F on Dwg. 11
IC25E on Dwg. 8
IC25B
Pedal Rhythm Auto Start to Anode D7 See Dwg. 11
IC20C on Dwg. 8
IC20D on Dwg. 11
IC20B
IC20A
IC6A
IC19F
KILLER ENABLE
SWING BASS KEYER
IC7D
20mS
Rhythm Playing Swing Bass Playing
SWING BASS/ GENIE BASS RESUME SWITCHER
From Swing Bass/Pedal Driver Q25 (Low after Keyer Pulse Decays) See Dwg. 14
P11
Q9
PEDAL DOWN SWING BASS/GENIE BASS KILLER
P16
Pedal Down Genie Bass Killer To Q32 Pt. S31 See Dwg. 14
MODE DETECTOR (Pedal or Keyboard)
SWING BASS SELECT & KEYER ENABLE
IC7B
IC7A
From Rhythm Tab On Line Pt. P60 (High with a Rhythm Tab on) See Dwg. 11
IC28C
RHYTHM & SWING BASS "ON" DETECTOR
IC28A, D on Dwg. 11
P18
Rhythm & Swing Bass "On" Genie Bass Killer to Q32 Pt. S32 See Dwg. 14
From Magic Swing Bass Tab (High with Tab on) See Dwg. 14
P38
47K
Wave-form at IC25C Pin 5
14mS
KD Initial Pedal Keydown

MAGIC MELODY & SWING BASS LOGIC

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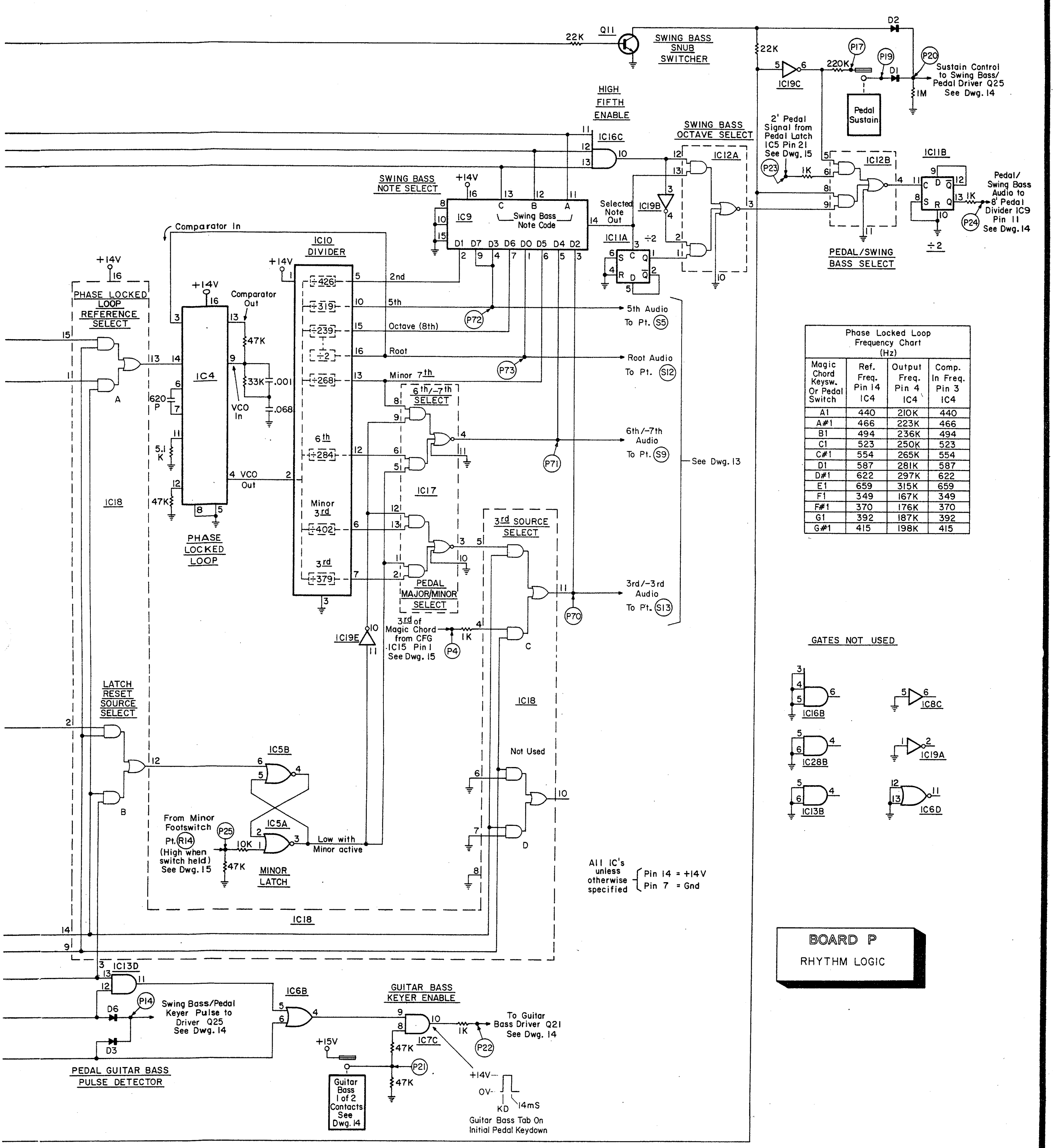


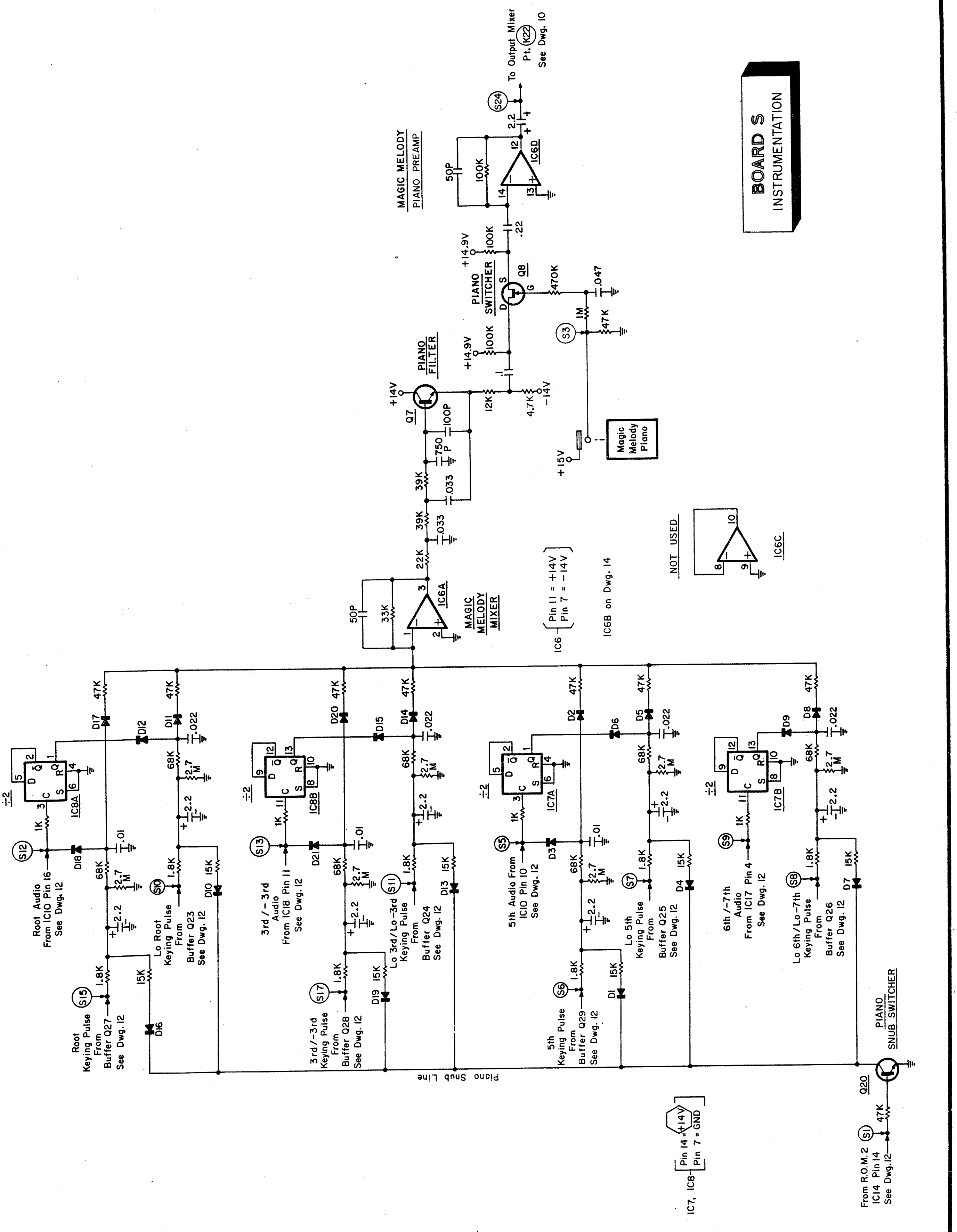
Q11
22K
SWING BASS SNUB SWITCHER
D2
22K
IC19C
220K
P17
P19
P20
D1
Sustain Control to Swing Bass/ Pedal Driver Q25 See Dwg. 14
1M
Pedal Sustain
HIGH FIFTH ENABLE
IC16C
SWING BASS OCTAVE SELECT
IC12A
2' Pedal Signal from Pedal Latch IC5 Pin 21 See Dwg. 15
P23
1K
IC12B
IC11B
Pedal/ Swing Bass Audio to 8' Pedal Divider IC9 Pin 11 See Dwg. 14
P24
÷2
PEDAL/SWING BASS SELECT
SWING BASS NOTE SELECT
+14V
IC9
Swing Bass Note Code
Selected Note Out
IC19B
IC11A
D1 D7 D3 D6 D0 D5 D4 D2
Comparator In
IC10 DIVIDER
÷426
÷319
÷239
÷2
÷268
6th ÷284
Minor 3rd ÷402
3rd ÷379
2nd
5th
Octave (8th)
Root
Minor 7th
6th/-7th SELECT
IC17
PEDAL MAJOR/MINOR SELECT
P72
P73
P71
P70
5th Audio To Pt. S5
Root Audio To Pt. S12
6th/-7th Audio To Pt. S9
3rd/-3rd Audio To Pt. S13
See Dwg. 13
PHASE LOCKED LOOP REFERENCE SELECT
A
IC18
Comparator Out
IC4
47K
33K
.001
.068
620 P
5.1 K
47K
VCO In
VCO Out
PHASE LOCKED LOOP
3rd SOURCE SELECT
C
3rd of Magic Chord from CFG IC15 Pin 1 See Dwg. 15
P4
IC19E
Not Used
D
LATCH RESET SOURCE SELECT
B
IC5B
IC5A
From Minor Footswitch Pt. R14 (High when switch held) See Dwg. 15
P25
10K
47K
Low with Minor active
MINOR LATCH
IC18
IC13D
D6
D3
P14
Swing Bass/Pedal Keyer Pulse to Driver Q25 See Dwg. 14
PEDAL GUITAR BASS PULSE DETECTOR
IC6B
GUITAR BASS KEYER ENABLE
IC7C
To Guitar Bass Driver Q21 See Dwg. 14
P22
P21
+15V
Guitar Bass 1 of 2 Contacts See Dwg. 14
+14V
0V
KD
14mS
Guitar Bass Tab On Initial Pedal Keydown
GATES NOT USED
IC16B
IC8C
IC28B
IC19A
IC13B
IC6D

Phase Locked Loop Frequency Chart (Hz)			
Magic Chord Keysw. Or Pedal Switch	Ref. Freq. Pin 14 IC4	Output Freq. Pin 4 IC4	Comp. In Freq. Pin 3 IC4
A1	440	210K	440
A#1	466	223K	466
B1	494	236K	494
C1	523	250K	523
C#1	554	265K	554
D1	587	281K	587
D#1	622	297K	622
E1	659	315K	659
F1	349	167K	349
F#1	370	176K	370
G1	392	187K	392
G#1	415	198K	415

All IC's unless otherwise specified
Pin 14 = +14V
Pin 7 = Gnd

BOARD P
RHYTHM LOGIC

13 MAGIC MELODY KEYING & FILTERING



BOARD S
INSTRUMENTATION
To Output Mixer Pt. K22 See Dwg. 10
S24
2.2
IC6D
12
14
13
50P
100K
MAGIC MELODY PIANO PREAMP
.22
+14.9V
100K
PIANO SWITCHER
Q8
D
S
G
470K
.047
S3
1M
47K
PIANO FILTER
+14.9V
100K
.1
+14V
Q7
12K
4.7K
-14V
100P
750P
39K
.033
39K
.033
22K
+15V
Magic Melody Piano
NOT USED
IC6C
10
8
9
IC6 (Pin 11 = +14V, Pin 7 = -14V)
IC6B on Dwg. 14
50P
33K
IC6A
3
1
2
MAGIC MELODY MIXER
÷2
IC8A
IC8B
IC7A
IC7B
D
Q
Q̄
C
S
R
47K
D17
D12
D11
.022
68K
2.7M
2.2
1K
.01
D18
1.8K
15K
D10
D16
D20
D15
D14
D21
D13
D19
D2
D6
D5
D3
D4
D1
D8
D9
D7
S12
Root Audio From IC10 Pin 16 See Dwg. 12
S10
Lo Root Keying Pulse From Buffer Q23 See Dwg. 12
S15
Root Keying Pulse From Buffer Q27 See Dwg. 12
S13
3rd / -3rd Audio From IC18 Pin 11 See Dwg. 12
S11
Lo 3rd/Lo-3rd Keying Pulse From Buffer Q24 See Dwg. 12
S17
3rd / -3rd Keying Pulse From Buffer Q28 See Dwg. 12
S5
5th Audio From IC10 Pin 10 See Dwg. 12
S7
Lo 5th Keying Pulse From Buffer Q25 See Dwg. 12
S6
5th Keying Pulse From Buffer Q29 See Dwg. 12
S9
6th / -7th Audio From IC17 Pin 4 See Dwg. 12
S8
Lo 6th/Lo-7th Keying Pulse From Buffer Q26 See Dwg. 12
Piano Snub Line
PIANO SNUB SWITCHER
Q20
47K
S1
From R.O.M. 2 IC14 Pin 14 See Dwg. 12
IC7, IC8 (Pin 14 = +14V, Pin 7 = GND)

BASS FILTERING

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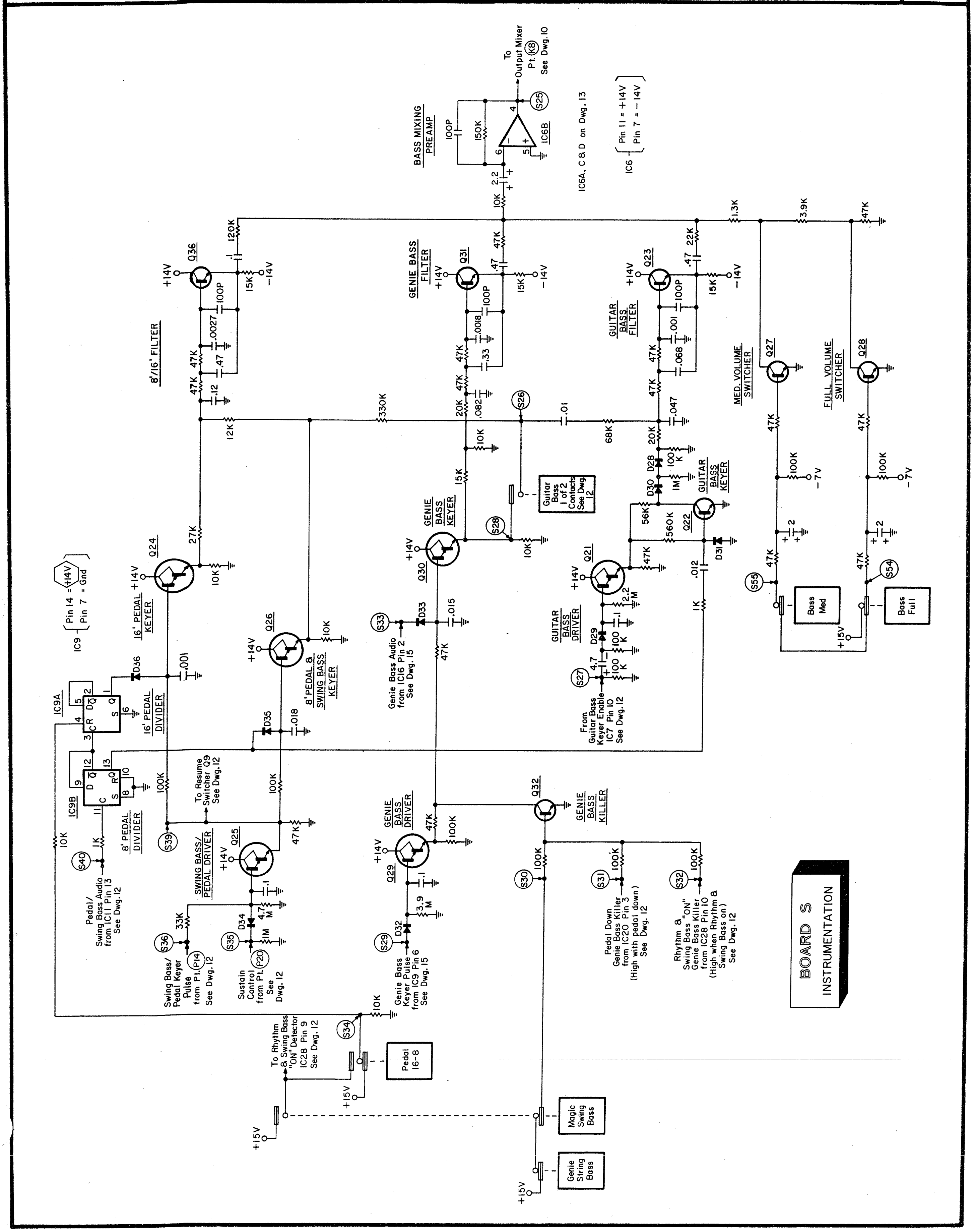
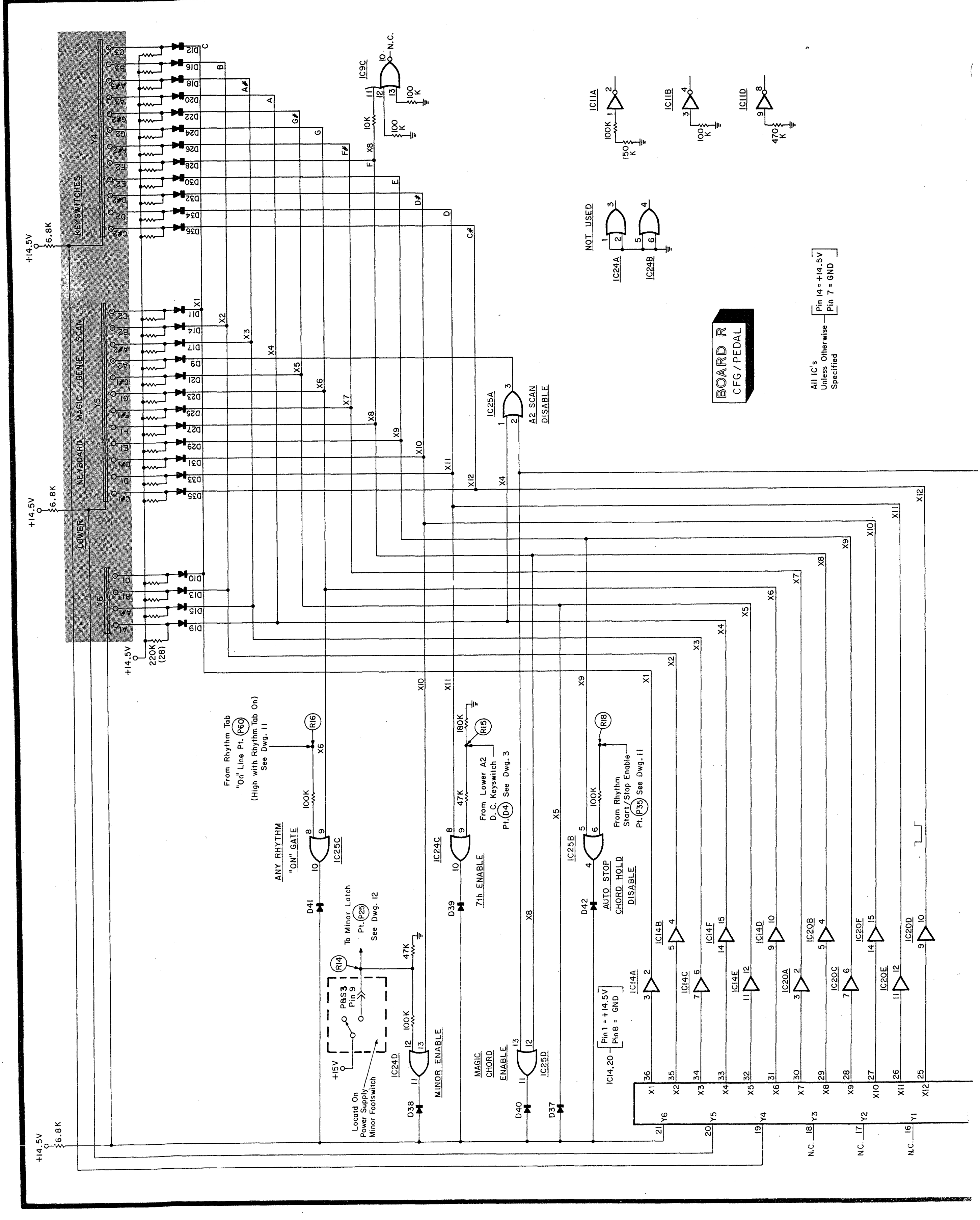

BASS MIXING PREAMP
IC6B
To Output Mixer Pt. K8 See Dwg. 10
S25
100P
150K
2.2
10K
IC6A, C & D on Dwg. 13
IC6 { Pin 11 = +14V Pin 7 = −14V }
8'/16' FILTER
Q36
GENIE BASS FILTER
Q31
GUITAR BASS FILTER
Q23
MED. VOLUME SWITCHER
Q27
FULL VOLUME SWITCHER
Q28
120K
1.3K
3.9K
47K
330K
12K
68K
.01
S26
Guitar Bass 1 of 2 Contacts See Dwg. 12
GENIE BASS KEYER
Q30
S28
GUITAR BASS KEYER
Q22
GUITAR BASS DRIVER
Q21
D28
D29
D30
D31
56K
560K
S27
From Guitar Bass Keyer Enable IC7 Pin 10 See Dwg. 12
S55
S54
Bass Med
Bass Full
−7V
+15V
IC9 { Pin 14 = +14V Pin 7 = Gnd }
16' PEDAL KEYER
Q24
8' PEDAL & SWING BASS KEYER
Q26
IC9A
16' PEDAL DIVIDER
D36
D35
IC9B
8' PEDAL DIVIDER
S39
To Resume Switcher Q9 See Dwg. 12
SWING BASS/ PEDAL DRIVER
Q25
S40
Pedal/ Swing Bass Audio from IC11 Pin 13 See Dwg. 12
S36
Swing Bass/ Pedal Keyer Pulse from Pt. P14 See Dwg. 12
S35
Sustain Control from Pt. P20 See Dwg. 12
D34
D33
S33
Genie Bass Audio from IC16 Pin 2 See Dwg. 15
GENIE BASS DRIVER
Q29
D32
S29
Genie Bass Keyer Pulse from IC9 Pin 6 See Dwg. 15
GENIE BASS KILLER
Q32
S30
S31
Pedal Down Genie Bass Killer from IC20 Pin 3 (High with pedal down) See Dwg. 12
S32
Rhythm & Swing Bass "ON" Genie Bass Killer from IC28 Pin 10 (High when Rhythm & Swing Bass on) See Dwg. 12
S34
To Rhythm & Swing Bass "ON" Detector IC28 Pin 9 See Dwg. 12
Pedal 16-8
Magic Swing Bass
Genie String Bass
+14V
−14V
BOARD S
INSTRUMENTATION

15

CFG, SOLO GENERATOR & PEDAL LATCH



LOWER KEYBOARD
KEYSWITCHES
MAGIC GENIE SCAN
Y4
Y5
Y6
+14.5V
6.8K
220K (28)
C3 B3 A#3 A3 G#3 G3 F#3 F3 E3 D#3 D3 C#3
C2 B2 A#2 A2 G#1 G1 F#1 F1 E1 D#1 D1 C#1
C1 B1 A#1 A1
D12 D16 D18 D20 D22 D24 D26 D28 D30 D32 D34 D36
D11 D14 D17 D9 D21 D23 D25 D27 D29 D31 D33 D35
D10 D13 D15 D19
C B A# A G# G F# F E D# D C#
X1 X2 X3 X4 X5 X6 X7 X8 X9 X10 X11 X12
IC9C
N.C.
10K
100K
IC11A
IC11B
IC11D
150K
470K
NOT USED
IC24A
IC24B
BOARD R
CFG / PEDAL
All IC's Unless Otherwise Specified
Pin 14 = +14.5V
Pin 7 = GND
IC25A
A2 SCAN DISABLE
From Rhythm Tab "On" Line Pt. P60 (High with Rhythm Tab On) See Dwg. 11
R16
ANY RHYTHM "ON" GATE
IC25C
D41
180K
R15
47K
From Lower A2 D.C. Keyswitch Pt. D4 See Dwg. 3
IC24C
7th ENABLE
D39
R18
From Rhythm Start/Stop Enable Pt. P35 See Dwg. 11
IC25B
AUTO STOP CHORD HOLD DISABLE
D42
To Minor Latch Pt. P25 See Dwg. 12
R14
P&S3 Pin 9
+15V
Located On Power Supply Minor Footswitch
IC24D
MINOR ENABLE
D38
MAGIC CHORD ENABLE
IC25D
D40
D37
IC14A IC14B IC14C IC14E IC14F IC14D
IC20A IC20B IC20C IC20E IC20F IC20D
IC14, 20 Pin 1 = +14.5V Pin 8 = GND
Y6 Y5 Y4 Y3 Y2 Y1
N.C.

CFG, SOLO GENERATOR & PEDAL LATCH

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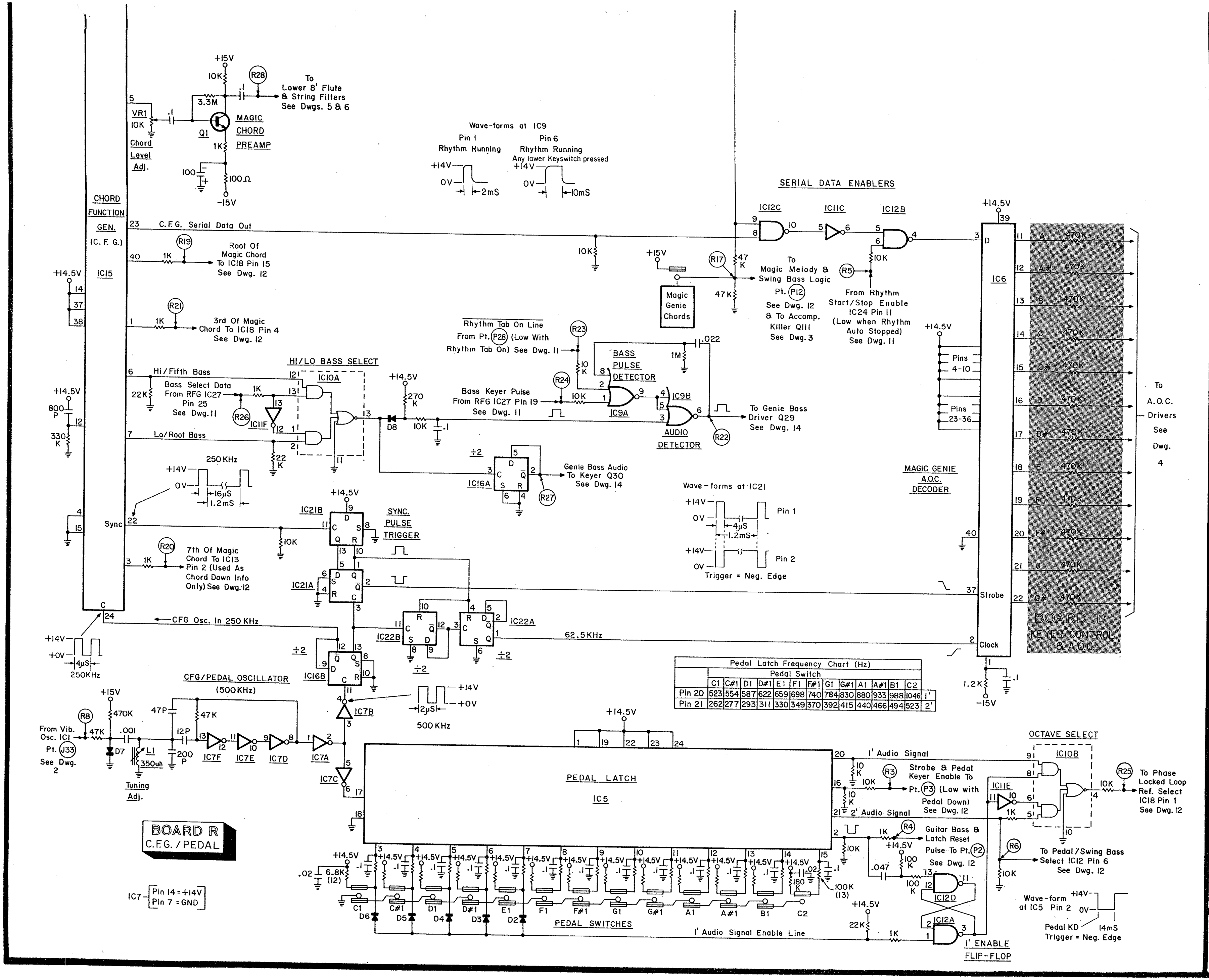
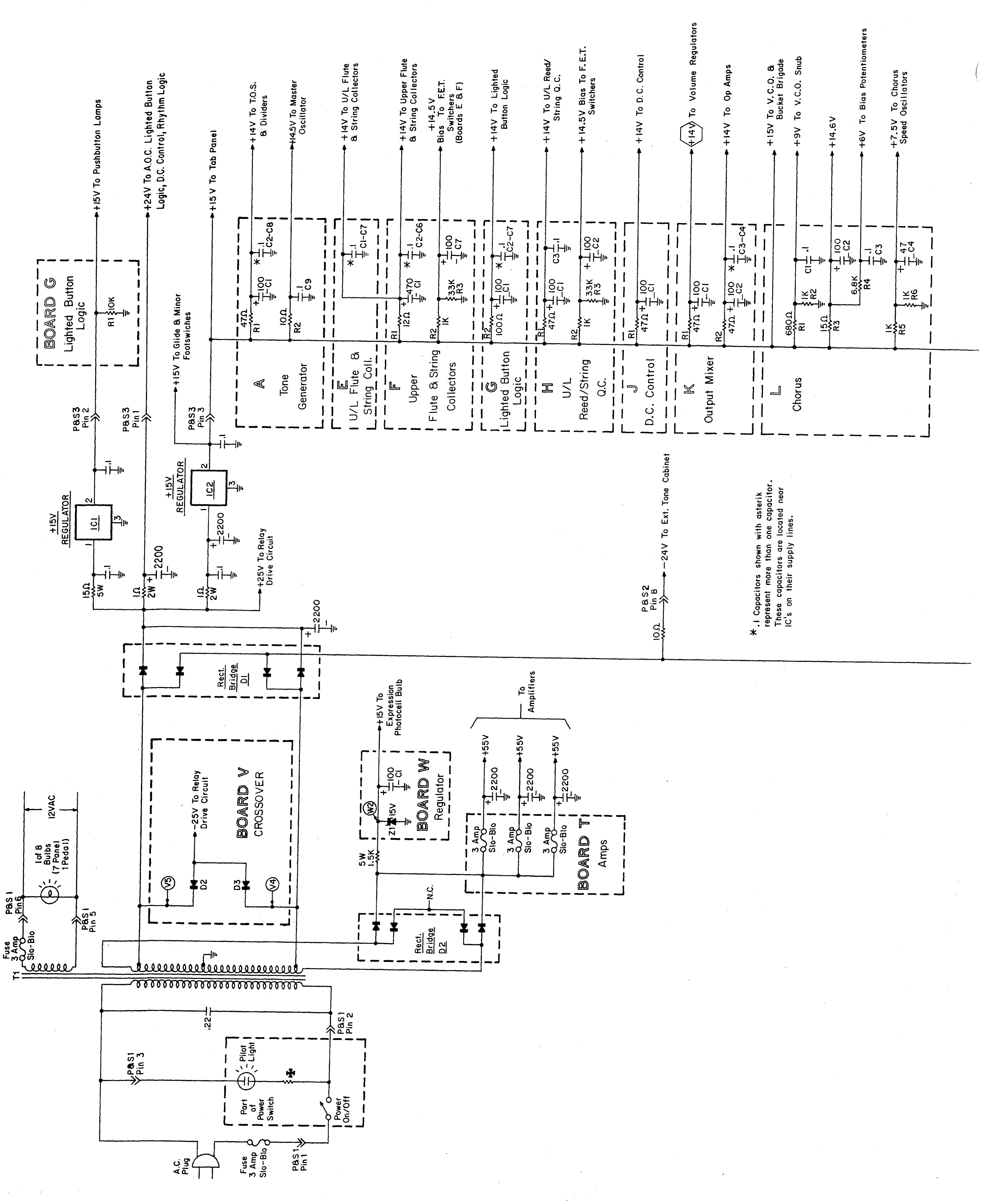

CHORD FUNCTION GEN. (C. F. G.) IC15
VR1 10K Chord Level Adj.
MAGIC CHORD PREAMP
Q1
3.3M
100Ω
+15V
-15V
To Lower 8' Flute & String Filters See Dwgs. 5 & 6
Wave-forms at IC9
Pin 1 Rhythm Running
Pin 6 Rhythm Running Any lower Keyswitch pressed
+14V
0V
2mS
10mS
C.F.G. Serial Data Out
Root Of Magic Chord To IC18 Pin 15 See Dwg. 12
3rd Of Magic Chord To IC18 Pin 4 See Dwg. 12
HI/LO BASS SELECT
IC10A
IC11F
Hi/Fifth Bass
Lo/Root Bass
Bass Select Data From RFG IC27 Pin 25 See Dwg. 11
250 KHz
16μS
1.2mS
Sync
7th Of Magic Chord To IC13 Pin 2 (Used As Chord Down Info Only) See Dwg. 12
CFG Osc. In 250 KHz
4μS
250KHz
IC21B
IC21A
SYNC. PULSE TRIGGER
IC22B
IC22A
IC16A
IC16B
÷2
62.5KHz
Rhythm Tab On Line From Pt. (P28) (Low With Rhythm Tab On) See Dwg. 11
Bass Keyer Pulse From RFG IC27 Pin 19 See Dwg. 11
BASS PULSE DETECTOR
IC9A
IC9B
AUDIO DETECTOR
D8
To Genie Bass Driver Q29 See Dwg. 14
Genie Bass Audio To Keyer Q30 See Dwg. 14
Magic Genie Chords
To Magic Melody & Swing Bass Logic Pt. (P12) See Dwg. 12 & To Accomp. Killer Q111 See Dwg. 3
From Rhythm Start/Stop Enable IC24 Pin 11 (Low when Rhythm Auto Stopped) See Dwg. 11
SERIAL DATA ENABLERS
IC12C
IC11C
IC12B
IC6
MAGIC GENIE A.O.C. DECODER
Pins 4-10
Pins 23-36
Strobe
Clock
A
A#
B
C
C#
D
D#
E
F
F#
G
G#
470K
BOARD D KEYER CONTROL & A.O.C.
To A.O.C. Drivers See Dwg. 4
Wave-forms at IC21
Pin 1
Pin 2
Trigger = Neg. Edge
CFG/PEDAL OSCILLATOR (500KHz)
From Vib. Osc. IC1 Pt. (J33) See Dwg. 2
D7
L1 350uh
Tuning Adj.
IC7F
IC7E
IC7D
IC7A
IC7B
IC7C
500 KHz
2μS
BOARD R C.F.G. / PEDAL
IC7 Pin 14 = +14V Pin 7 = GND
PEDAL LATCH IC5
PEDAL SWITCHES
C1
C#1
D1
D#1
E1
F1
F#1
G1
G#1
A1
A#1
B1
C2
D2
D3
D4
D5
D6
1' Audio Signal Enable Line
1' Audio Signal
2' Audio Signal
Strobe & Pedal Keyer Enable To Pt. (P3) (Low with Pedal Down) See Dwg. 12
Guitar Bass & Latch Reset Pulse To Pt. (P2) See Dwg. 12
IC12D
IC12A
1' ENABLE FLIP-FLOP
OCTAVE SELECT
IC10B
IC11E
To Phase Locked Loop Ref. Select IC18 Pin 1 See Dwg. 12
To Pedal/Swing Bass Select IC12 Pin 6 See Dwg. 12
Wave-form at IC5 Pin 2
Pedal KD
14mS
Trigger = Neg. Edge

Pedal Latch Frequency Chart (Hz)														
	Pedal Switch													
	C1	C#1	D1	D#1	E1	F1	F#1	G1	G#1	A1	A#1	B1	C2	
Pin 20	523	554	587	622	659	698	740	784	830	880	933	988	1046	1'
Pin 21	262	277	293	311	330	349	370	392	415	440	466	494	523	2'

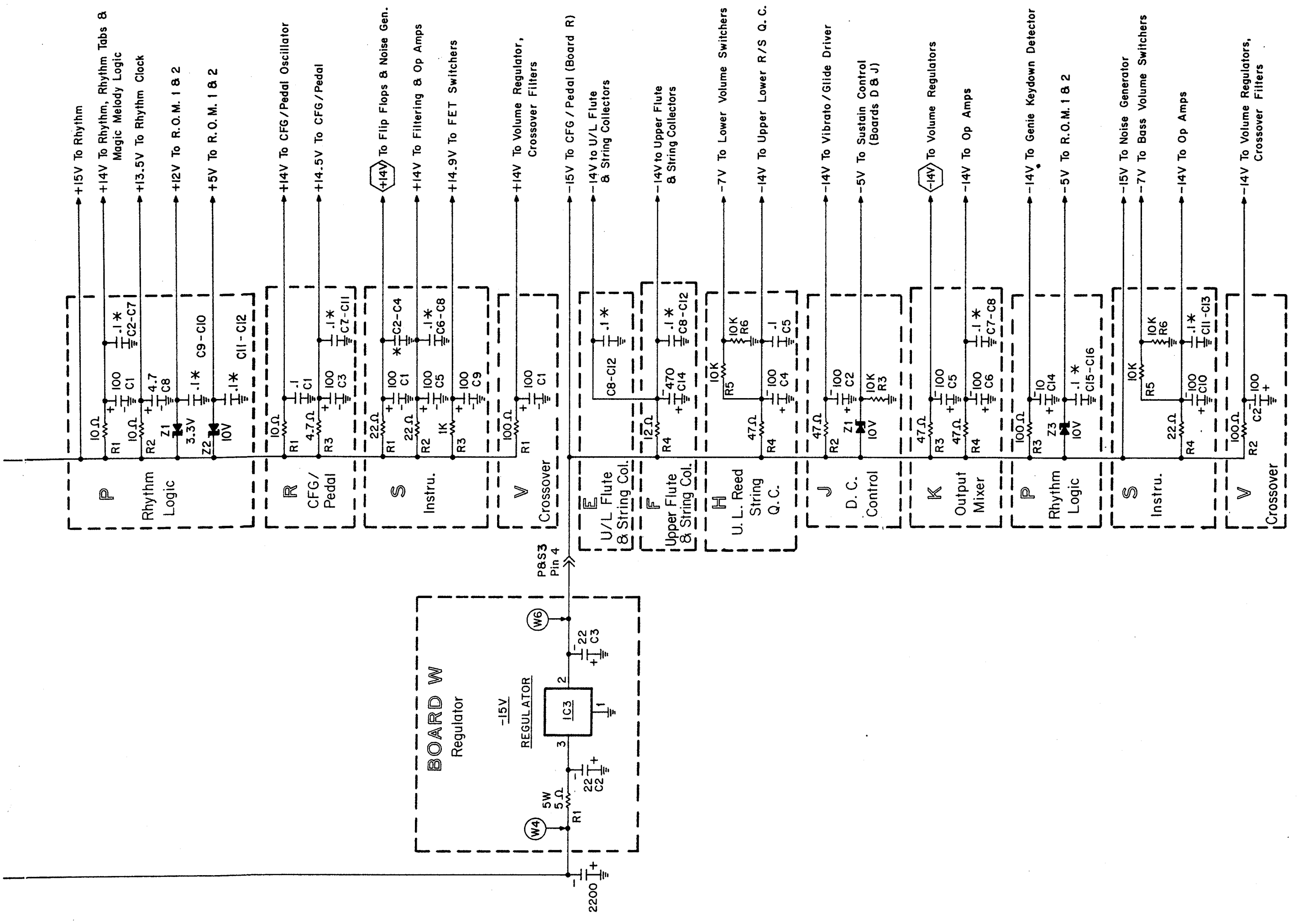
16 POWER SUPPLY



+15V To Pushbutton Lamps
+24V To A.O.C. Lighted Button Logic, D.C. Control, Rhythm Logic
+15 V To Tab Panel
+14V To T.O.S. & Dividers
+14.5V To Master Oscillator
+14V To U/L Flute & String Collectors
+14V To Upper Flute & String Collectors
+14.5V Bias To F.E.T. Switchers (Boards E & F)
+14V To Lighted Button Logic
+14V To U/L Reed/String Q.C.
+14.5V Bias To F.E.T. Switchers
+14V To D.C. Control
+14V To Volume Regulators
+14V To Op Amps
+15V To V.C.O. & Bucket Brigade
+9V To V.C.O. Snub
+14.6V
+6V To Bias Potentiometers
+7.5V To Chorus Speed Oscillators
BOARD G
Lighted Button Logic
R1 10K
+15V To Glide & Minor Footswitches
A
Tone Generator
E
U/L Flute & String Coll.
F
Upper Flute & String Collectors
G
Lighted Button Logic
H
U/L Reed/String Q.C.
J
D.C. Control
K
Output Mixer
L
Chorus
R1 47Ω
R2 10Ω
.1 C2-C8
100 C1
.1 C9
.1 C1-C7
R1 12Ω
470 C1
.1 C2-C6
R2 1K
33K R3
100 C7
R2 100Ω
100 C1
.1 C2-C7
R1 47Ω
100 C1
C3 .1
R2 1K
33K R3
100 C2
R1 47Ω
100 C1
R1 47Ω
100 C1
R2 47Ω
100 C2
.1 C3-C4
R1 680Ω
C1 .1
1K R2
R3 15Ω
100 C2
6.8K R4
.1 C3
R5 1K
1K R6
47 C4
P&S3 Pin 2
P&S3 Pin 1
P&S3 Pin 3
+15V REGULATOR
IC1
IC2
15Ω 5W
1Ω 2W
2200
+25V To Relay Drive Circuit
P&S2 Pin 8
−24V To Ext. Tone Cabinet
10Ω
Rect. Bridge D1
+15V To Expression Photocell Bulb
To Amplifiers
+55V
2200
BOARD W
Regulator
Z1 15V
W2
5W 1.5K
3 Amp Slo-Blo
BOARD T
Amps
BOARD V
CROSSOVER
−25V To Relay Drive Circuit
V5
D2
D3
V4
N.C.
Rect. Bridge D2
P&S1 Pin 6
P&S1 Pin 5
12VAC
1 of 8 Bulbs (7 Panel 1 Pedal)
Fuse 3 Amp Slo-Blo
T1
.22
P&S1 Pin 2
P&S1 Pin 3
Pilot Light
Part of Power Switch
Power On/Off
A.C. Plug
Fuse 3 Amp Slo-Blo
P&S1 Pin 1

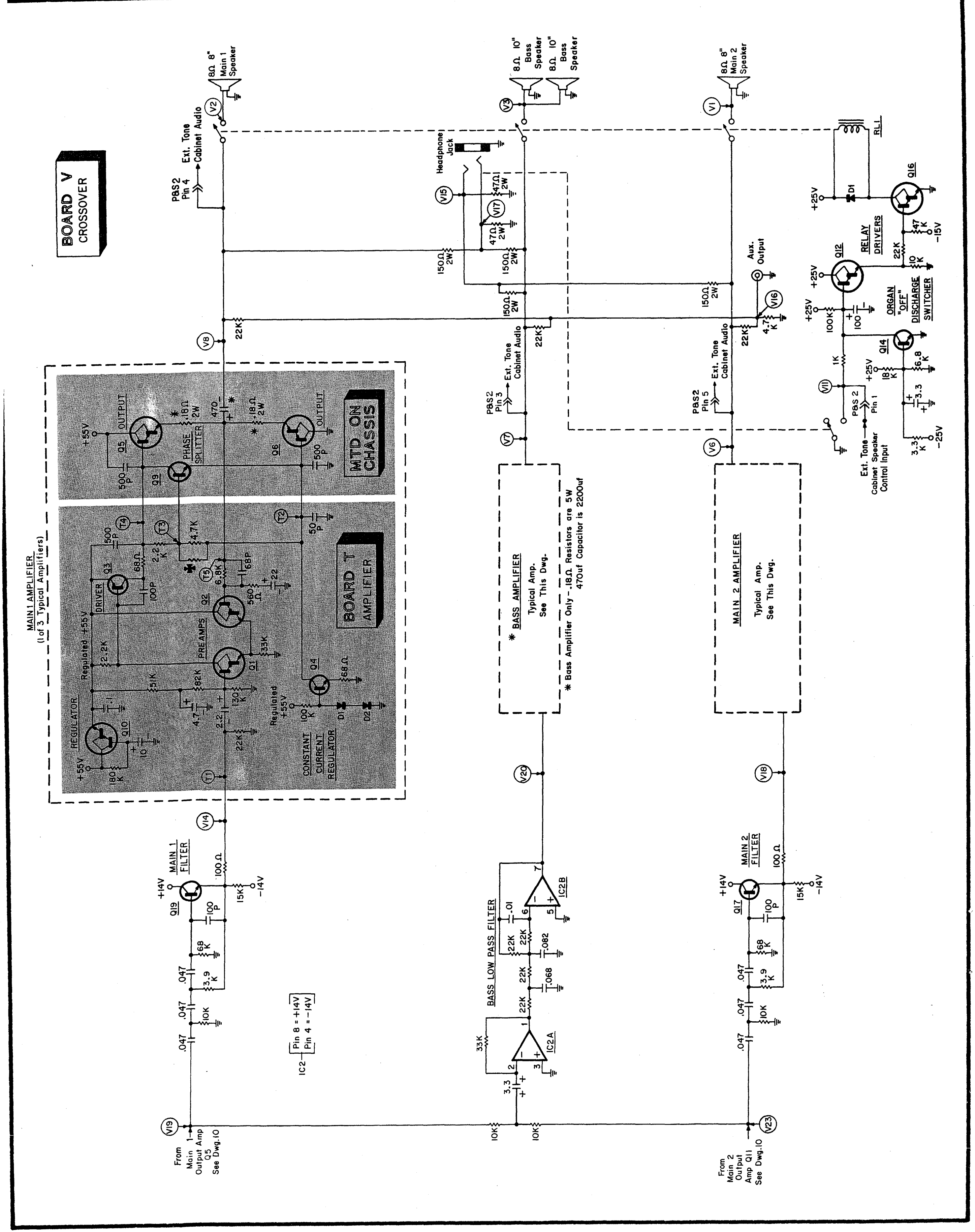
*.1 Capacitors shown with asterik represent more than one capacitor. These capacitors are located near IC's on their supply lines.

POWER SUPPLY


+15V To Rhythm
+14V To Rhythm, Rhythm Tabs & Magic Melody Logic
+13.5V To Rhythm Clock
+12V To R.O.M. 1 & 2
+5V To R.O.M. 1 & 2
+14V To CFG/Pedal Oscillator
+14.5V To CFG/Pedal
+14V To Flip Flops & Noise Gen.
+14V To Filtering & Op Amps
+14.9V To FET Switchers
+14V To Volume Regulator, Crossover Filters
-15V To CFG/Pedal (Board R)
-14V to U/L Flute & String Collectors
-14V to Upper Flute & String Collectors
-7V To Lower Volume Switchers
-14V To Upper Lower R/S Q.C.
-14V To Vibrato/Glide Driver
-5V To Sustain Control (Boards D & J)
-14V To Volume Regulators
-14V To Op Amps
-14V To Genie Keydown Detector
-5V To R.O.M. 1 & 2
-15V To Noise Generator
-7V To Bass Volume Switchers
-14V To Op Amps
-14V To Volume Regulators, Crossover Filters
P Rhythm Logic
R CFG/Pedal
S Instru.
V Crossover
E U/L Flute & String Col.
F Upper Flute & String Col.
H U.L. Reed String Q.C.
J D.C. Control
K Output Mixer
P Rhythm Logic
S Instru.
V Crossover
P&S3 Pin 4
BOARD W Regulator
-15V REGULATOR
IC3
W6
W4
R1 5W 5Ω
22 C2
22 C3
2200
10Ω R1
100 C1
.1* C2-C7
10Ω R2
4.7 C8
Z1 3.3V
.1* C9-C10
Z2 10V
.1* C11-C12
10Ω R1
.1 C1
4.7Ω R3
100 C3
.1* C7-C11
22Ω R1
100 C1
*C2-C4
22Ω R2
100 C5
.1* C6-C8
1K R3
100 C9
100Ω R1
100 C1
.1* C8-C12
12Ω R4
470 C14
.1* C8-C12
10K R5
10K R6
.1 C5
47Ω R4
100 C4
47Ω R2
100 C2
Z1 10V
10K R3
47Ω R3
100 C5
47Ω R4
100 C6
.1* C7-C8
100Ω R3
10 C14
Z3 10V
.1* C15-C16
10K R5
10K R6
.1* C11-C13
22Ω R4
100 C10
100Ω R2
100 C2

POWER
SUPPLY
CHASSIS

17 CROSSOVER FILTERS & AMPLIFIERS



BOARD V
CROSSOVER
8Ω 8" Main 1 Speaker
8Ω 10" Bass Speaker
8Ω 10" Bass Speaker
8Ω 8" Main 2 Speaker
V2
V3
V1
Ext. Tone Cabinet Audio
PBS2 Pin 4
PBS2 Pin 3
PBS2 Pin 5
Headphone Jack
V15
V17
47Ω 2W
47Ω 2W
150Ω 2W
150Ω 2W
150Ω 2W
150Ω 2W
Aux. Output
V16
4.7 K
22K
22K
22K
V8
V7
V6
RL1
D1
Q16
+25V
47 K
-15V
Q12
RELAY DRIVERS
22K
10 K
100K
100
ORGAN "OFF" DISCHARGE SWITCHER
Q14
1K
18 K
6.8 K
V11
PBS 2 Pin 1
3.3
3.3 K
-25V
Ext. Tone Cabinet Speaker Control Input
MAIN 1 AMPLIFIER
(1 of 3 Typical Amplifiers)
+55V
Q5
OUTPUT
PHASE SPLITTER
Q9
18Ω 2W
18Ω 2W
470
Q6
OUTPUT
500 P
500 P
MTD ON CHASSIS
BOARD T
AMPLIFIER
T4
T3
T2
T5
T1
500 P
4.7K
50 P
Q3
DRIVER
68Ω
100P
2.2 K
6.8K
68P
22
560 Ω
Q2
Regulated +55V
2.2K
PREAMPS
Q1
33K
51K
82K
Q4
68Ω
REGULATOR
Q10
10
4.7
2.2
130 K
Regulated +55V
100 K
D1
D2
180 K
22K
CONSTANT CURRENT REGULATOR
* BASS AMPLIFIER
Typical Amp. See This Dwg.
* Bass Amplifier Only - .18Ω Resistors are 5W
470uf Capacitor is 2200uf
MAIN 2 AMPLIFIER
Typical Amp. See This Dwg.
V14
V20
V18
MAIN 1 FILTER
Q19
+14V
100Ω
15K
-14V
100 P
68 K
3.9 K
.047
.047
.047
10K
BASS LOW PASS FILTER
.01
22K
22K
.082
22K
.068
22K
33K
IC2B
IC2A
3.3
MAIN 2 FILTER
Q17
+14V
100Ω
15K
-14V
100 P
68 K
3.9 K
.047
.047
.047
10K
IC2 [Pin 8 = +14V, Pin 4 = -14V]
V19
10K
10K
V23
From Main 1 Output Amp Q5 See Dwg.10
From Main 2 Output Amp Q11 See Dwg.10

TRANSISTOR BASING DIAGRAM

FIG. A

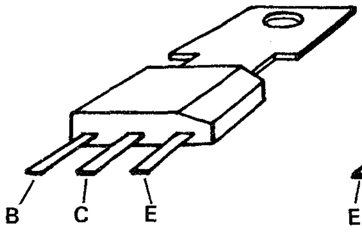


FIG. B

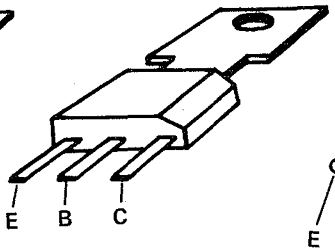


FIG. C

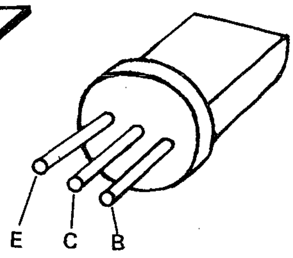


FIG. D

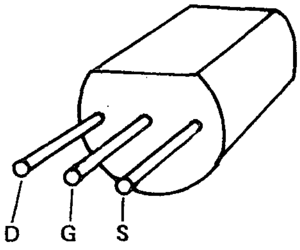


FIG. E

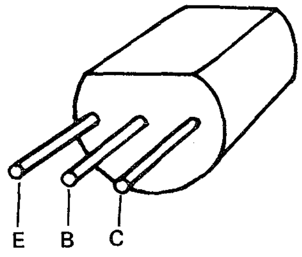


FIG. F

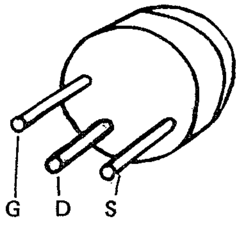


FIG. G

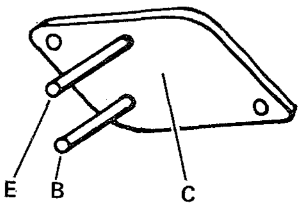


FIG. H

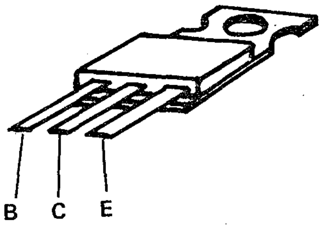


FIG. J

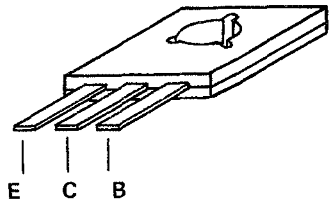


FIG. K

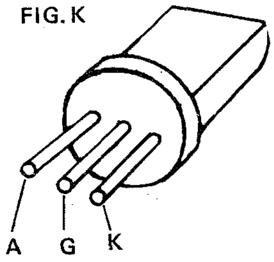


FIG. L

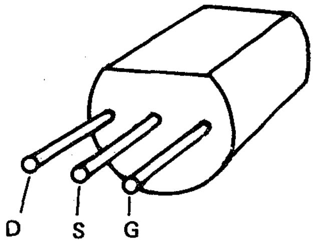
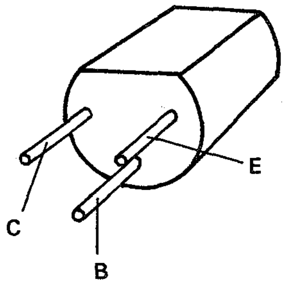


FIG. M



PART NUMBER	FIGURE	PART NUMBER	FIGURE	PART NUMBER	FIGURE	PART NUMBER	FIGURE
992-001192	G	991-012328	F	991-016727	C	992-024185	G
991-002232	C	991-012396	F	991-016788	C	991-024184	C
991-002271	G	991-012686	F	992-017169	G	991-025535	E or M
991-002298	C	992-013170	A	991-017456	F	991-026039	G
991-002356	C	991-013543	C	991-018238	C	991-026040	G
991-002873	C	991-013544	C	991-018047	E	991-026028	G
991-002888	C	991-013599	C	991-018237	B	991-026054	C
992-003139	G	991-015000	A	991-018493	E	991-026617	C
991-003304	C	991-015001	A	992-020432	G	991-026315	C
991-008393	C	991-015062	A	991-020425	H	991-028269	L
991-008394	C	991-015063	A	991-020426	H	991-028691	C
992-008890	G	991-015316	K	992-022201	G		
991-010098	C	991-015587	C	991-021451	J		
991-010462	C	991-015614	C	991-021450	J		
991-011576	D	991-015663	C	992-022773	G		
991-011706	D	991-016274	C	991-022774	L		

TRUTH TABLES

LOWREY PART NO.	MFG. PART. NO.	FIG.
991-025515	CD4011	1
991-025516	CD4071	2
991-025517	CD4081	3
991-025599	CD4532	4
991-026006	CD4520	5
991-026022	CD4027	6
991-026025	CD4001	7
991-027358	CD4013	8
991-028682-001	CD4025	9
991-028684-001	CD4073	10
991-028689-001	CD4512	11

FIG. 1

NAND

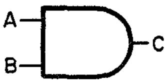
A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

FIG. 2

OR

A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

FIG. 3



AND

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

FIG. 4

PRIORITY ENCODER

	INPUT									OUTPUT				
Pin No →	5	4	3	2	1	13	12	11	10	14	6	7	9	15
	0	X	X	X	X	X	X	X	X	0	0	0	0	0
	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	1	1	X	X	X	X	X	X	X	1	1	1	1	0
	1	0	1	X	X	X	X	X	X	1	1	1	0	0
	1	0	0	1	X	X	X	X	X	1	1	0	1	0
	1	0	0	0	1	X	X	X	X	1	1	0	0	0
	1	0	0	0	0	1	X	X	X	1	0	1	1	0
	1	0	0	0	0	0	1	X	X	1	0	1	0	0
	1	0	0	0	0	0	0	1	X	1	0	0	1	0
	1	0	0	0	0	0	0	0	1	1	0	0	0	0

X = Don't Care

FIG. 5

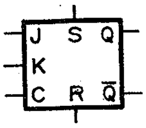
COUNTER

CLOCK	ENABLE	RESET	ACTION
↑	1	0	Counter
0	↓	0	Counter
↑	0	0	No Change
1	↓	0	No Change
X	X	1	Q1–Q4=0

X = Don't Care

TRUTH TABLES

FIG. 6

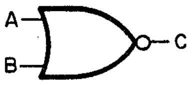


J-K FLIP-FLOP

T_n					T_n+1	
J	K	S	R	Clk	Q	$\overline{Q}$
1	0	0	0	ʃ	1	0
0	1	0	0	ʃ	0	1
0	0	0	0	ʃ	Q_n	$\overline{Q}_n$
1	1	0	0	ʃ	$\overline{Q}_n$	Q_n
X	X	0	1	X	0	1
X	X	1	0	X	1	0
X	X	1	1	X	1	1

X = Don't Care

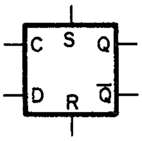
FIG. 7



NOR

A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

FIG. 8

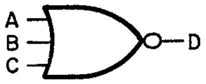


D FLIP-FLOP

T_n				T_n+1	
D	S	R	Clk	Q	$\overline{Q}$
1	0	0	ʃ	1	0
0	0	0	ʃ	0	1
X	0	1	X	0	1
X	1	0	X	1	0
X	1	1	X	1	1

X = Don't Care

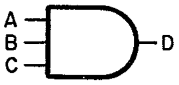
FIG. 9



TRIPLE-INPUT NOR

A	B	C	D
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

FIG. 10



TRIPLE-INPUT AND

A	B	C	D
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

FIG. 11

SELECTOR

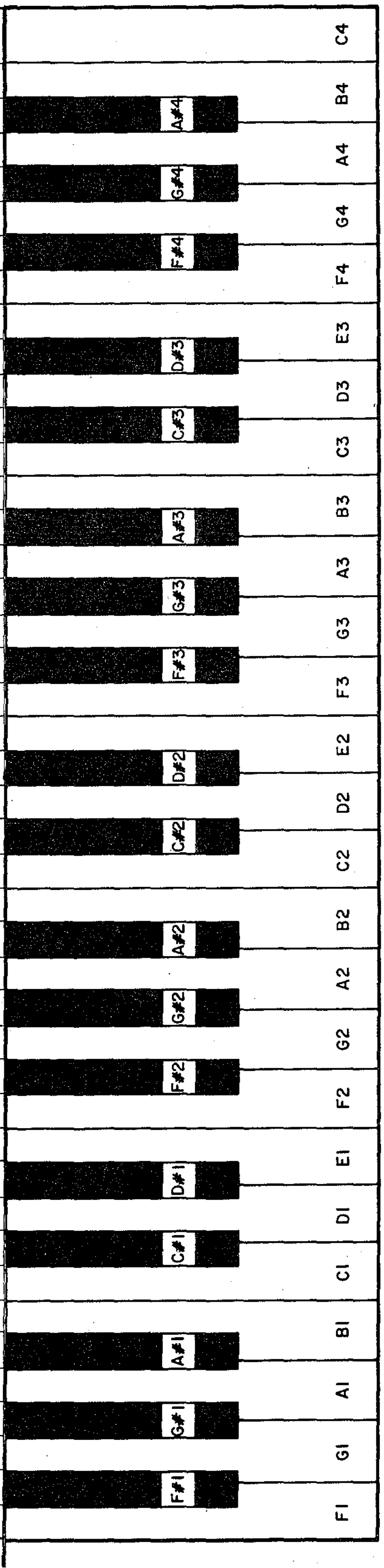
	INPUT			INHIBIT	DISABLE	OUTPUT
Pin No. →	13	12	11	10	15	14
	0	0	0	0	0	D0
	0	0	1	0	0	D1
	0	1	0	0	0	D2
	0	1	1	0	0	D3
	1	0	0	0	0	D4
	1	0	1	0	0	D5
	1	1	0	0	0	D6
	1	1	1	0	0	D7
	X	X	X	1	0	0
	X	X	X	X	1	HIGH Z

X = Don't Care

FREQUENCY DISTRIBUTION CHART

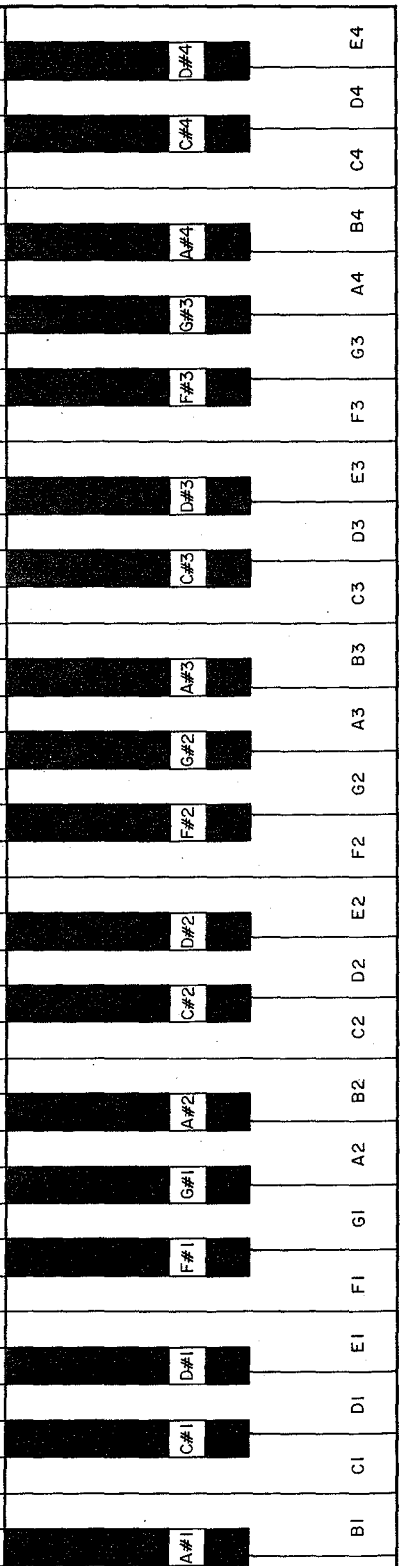
UPPER KEYBOARD

Voice Footages	Octave Frequency of Audio Signal																																											
16'	F2	F#2	G2	G#2	A2	A#2	B2	C3	C#3	D3	D#3	E3	F3	F#3	G3	G#3	A3	A#3	B3	C4	C#4	D4	D#4	E4	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6
8'	F3	F#3	G3	G#3	A3	A#3	B3	C4	C#4	D4	D#4	E4	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7
4'	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7	C#7	D7	D#7	E7	F7	F#7	G7	G#7	A7	A#7	B7	C8
$2\frac{2}{3}$'	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7	C#7	D7	D#7	E7	F7	F#7	G7	G#7	A7	A#7	B7	C8	C#8	D8	D#8	E8	F8	F#8	G8
2'	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6	F6	F#6	G6	G#6	A6	A#6	B6	C7	C#7	D7	D#7	E7	F7	F#7	G7	G#7	A7	A#7	B7	C8	C#8	D8	D#8	E8	F8	F#8	G8	G#8	A8	A#8	B8	C9


F1
F#1
G1
G#1
A1
A#1
B1
C1
C#1
D1
D#1
E1
F2
F#2
G2
G#2
A2
A#2
B2
C2
C#2
D2
D#2
E2
F3
F#3
G3
G#3
A3
A#3
B3
C3
C#3
D3
D#3
E3
F4
F#4
G4
G#4
A4
A#4
B4
C4

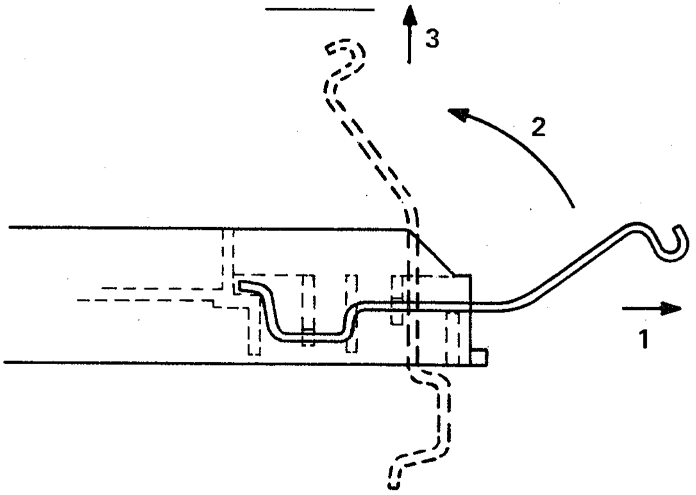
LOWER KEYBOARD

Voice Footage	Octave Frequency of Audio Signal																																											
8'	A2	A#2	B2	C3	C#3	D3	D#3	E3	F3	F#3	G3	G#3	A3	A#3	B3	C4	C#4	D4	D#4	E4	F4	F#4	G4	G#4	A4	A#4	B4	C5	C#5	D5	D#5	E5	F5	F#5	G5	G#5	A5	A#5	B5	C6	C#6	D6	D#6	E6


A1
A#1
B1
C1
C#1
D1
D#1
E1
F1
F#1
G1
G#1
A2
A#2
B2
C2
C#2
D2
D#2
E2
F2
F#2
G2
G#2
A3
A#3
B3
C3
C#3
D3
D#3
E3
F3
F#3
G3
G#3
A4
A#4
B4
C4
C#4
D4
D#4
E4

KEYSWITCH ACTUATOR REPLACEMENT

Fig. 1

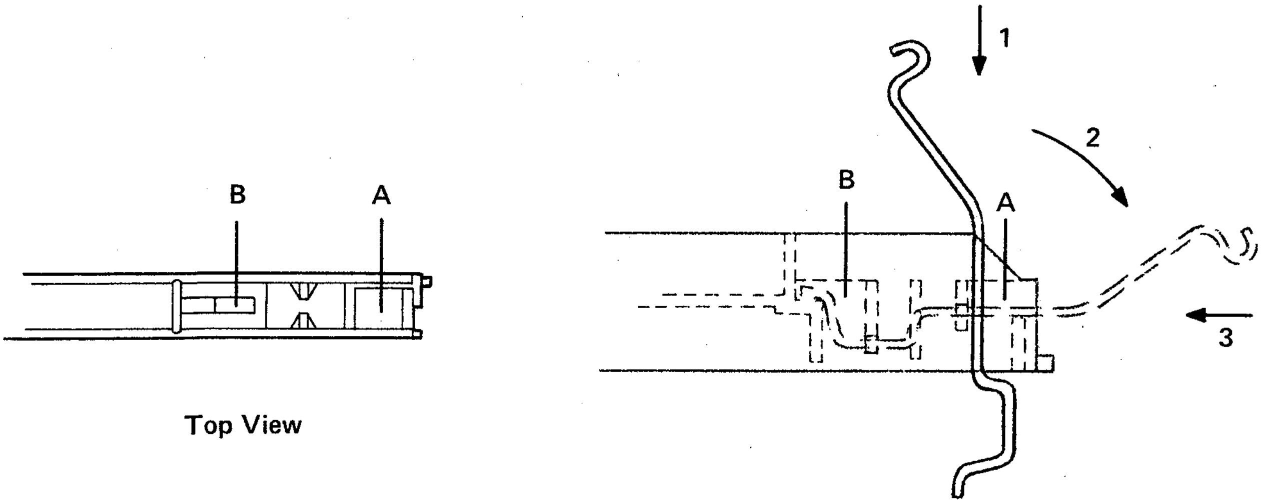


Side View

To remove wire actuator

1. Using pliers, pull wire actuator outward until it stops.
2. Rotate upward to a vertical position.
3. Lift wire actuator vertically from key.

Fig. 2



Top View

Side View

To replace wire actuator

1. Holding hooked end, insert wire actuator vertically into opening A.
2. Rotate downward so that straight end positions into Slot B.
3. Using pliers, push wire actuator inward until it stops.

RHYTHM PATTERN CHARTS

Intro I

	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	High Drum	●																●															
	Snare	●						●		●						●		●		●				●				●		●		●	
	Bongo									●						●												●					
	Cymbal	●								●																							
	Tom Tom																													●		●	
	Bass Drum																															●	
Swing Bass	8th	●																															
	6th/−7th									●																						●	
	5th																											●		●			
	2nd																	●		●													
	Snub																	●										●				●	

Intro II

	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	RHYTHM COUNT	1	&	a	2	&	a	3	&	a	4	&	a	1	&	a	2	&	a	3	&	a	4	&	a
Instrumentation	Snare			●	●		●			●	●		●	●	●	●	●	●	●	●			●		●
	Low Drum																●	●							
	Bongo																●	●	●				●		
	Tom Tom																			●					
	Cymbal	●						●												●			●		●
	Cymbal Snub																						●		●
	Bass Drum	●						●						●						●					
Swing Bass	5th																						●		
	3rd/−3rd																			●					
	2nd															●									

RHYTHM PATTERN CHARTS

RHYTHM 1

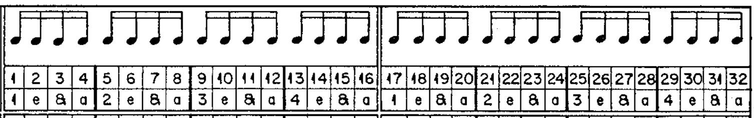
TRACK A

Ballad

	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	RHYTHM COUNT	1	&	a	2	&	a	3	&	a	4	&	a	1	&	a	2	&	a	3	&	a	4	&	a
Instrumentation	Snare							●												●					
	Cymbal																							●	
	Brush	●		●	●	●		●		●		●		●		●	●	●		●		●		●	
	Brush Snub	●		●	●	●		●		●		●		●		●	●	●		●		●		●	
	Bass Drum	●										●		●										●	
Lower Keyboard	Chord	●						●				●		●						●		●		●	
	* Accent							●												●					
	Chord Sustain	●										●		●										●	
Genie Bass	5th													●						●				●	
	Root	●						●																	
Magic Melody	5th							●												●					
	3rd/–3rd					●				●								●				●			
	Root			●				●				●				●				●				●	
	Low 5th	●				●				●				●				●				●			
	Lo 3rd/Lo –3rd			●								●				●								●	
	Low Root	●												●											
Swing Bass	5th													●										●	
	3rd/–3rd							●												●					
	Root	●																							

TRACK B

Tango



	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Snare	●				●				●				●		●	●	●				●				●				●		●	●
	Cymbal															●																●	
	Bass Drum	●				●				●				●		●		●				●				●				●		●	
Lower Keyboard	Chord	●				●				●				●		●				●				●		●				●		●	
	* Accent															●																●	
	Chord Sustain															●																●	
Genie Bass	5th									●				●												●				●			
	Root	●				●												●				●											
Magic Melody	3rd/–3rd													●																●			
	Root	●								●								●								●							
	Low 5th							●						●										●						●			
	Lo 3rd/Lo –3rd	●								●								●								●							
	Low Root							●																●									
	Snub							●		●				●										●		●				●			
Swing Bass	5th									●								●															
	3rd/–3rd					●								●								●								●			
	Root	●																								●							

TRACK C

Rock

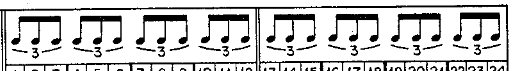
	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Snare					●								●								●								●			
	Cymbal	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Cymbal Snub	●		●		●		●		●				●		●		●		●		●		●		●				●		●	
	Bass Drum	●						●		●								●						●		●							
Lower Keyboard	Chord					●		●						●								●		●						●			
	* Accent													●																●			
	Chord Sustain					●								●								●								●			
Genie Bass	5th									●																●							
	Root	●						●										●						●									
Magic Melody	Root	●		●						●		●						●		●						●		●					
	Lo 6th/Lo –7th							●								●								●								●	
	Low 5th					●								●								●								●			
	Lo 3rd/Lo –3rd	●		●						●		●						●		●						●		●					
	Snub	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
Swing Bass	8th																	●															
	7th																					●											
	6th/–7th													●										●									
	5th									●						●										●						●	
	3rd/–3rd					●		●																						●			
	Root	●																															
	Snub					●		●						●		●						●		●						●		●	

* Accent refers to Lower Keyboard Accent Circuit located on Drawing 8.

RHYTHM PATTERN CHARTS

RHYTHM 2

TRACK A



Dixie	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	RHYTHM COUNT	1	&	a	2	&	a	3	&	a	4	&	a	1	&	a	2	&	a	3	&	a	4	&	a
Instrumentation	Snare				●						●						●					●	●		
	Cymbal	●			●		●	●			●		●	●			●		●	●			●		●
	Cymbal Snub				●		●				●		●				●		●				●		●
	Brush				●						●						●						●		
	Brush Snub				●						●						●						●		
	Bass Drum	●						●						●						●					
Lower Keyboard	Chord	●			●			●			●			●			●			●		●	●		
	* Accent				●						●						●						●		
	Chord Sustain	●						●						●						●		●			
Genie Bass	5th							●												●					
	Root	●												●											
Magic Melody	3rd/–3rd	●					●				●			●			●								
	Root				●					●										●			●		
	Low 5th			●				●					●			●			●			●			●
	Snub			●			●			●			●			●			●			●			●
Swing Bass	8th													●											
	5th										●						●								
	3rd/–3rd							●												●					●
	2nd				●																		●		
	Root	●																							
	Snub																								●

TRACK B

Samba	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	High Drum									●																		●					
	Low Drum									●																		●					
	Tom Tom									●																●							
	Bongo	●						●										●		●				●									
	Snare	●				●										●				●				●						●			
	Cymbal	●						●		●						●		●						●		●						●	
	Brush	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Brush Snub					●		●						●		●						●		●						●		●	
	Bass Drum	●								●								●								●							
Lower Keyboard	Chord	●				●				●		●				●				●				●				●		●			
	* Accent	●				●										●				●				●									
	Chord Sustain									●						●								●									
Genie Bass	5th									●																●							
	Root	●																●															
Magic Melody	Lo 6th/Lo –7th									●																●				●			
	Low 5th	●				●										●				●				●									
	Lo 3rd/Lo –3rd	●				●				●						●				●				●		●				●			
	Snub																							●									
Swing Bass	8th	●						●										●						●									
	5th									●																●							
	Snub							●																●									

TRACK C

Hard Rock	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Snare					●								●								●								●			
	Low Drum								●																●		●						
	Cymbal								●							●									●		●					●	
	Cymbal Snub								●																●		●						
	Brush	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Brush Snub	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Bass Drum	●		●						●		●						●		●						●		●					
Lower Keyboard	Chord					●			●					●								●			●					●			
	* Accent													●																●			
	Chord Sustain					●								●								●								●			
Genie Bass	5th									●																●							
	Root	●		●														●		●													
Magic Melody	Root					●								●		●						●				●				●		●	
	Lo 6th/Lo –7th															●																●	
	Low 5th			●		●								●						●		●				●				●			
	Low Root	●										●						●							●			●					
	Snub	●		●								●				●		●		●					●	●		●				●	
Swing Bass	8th					●																●											
	–7th															●										●							
	6th/–7th																										●						
	5th			●								●		●											●			●				●	
	3rd/–3rd																													●			
	Root	●																●															
	Snub	●		●								●		●											●	●	●	●				●	

* Accent refers to Lower Keyboard Accent Circuit located on Drawing 8.

RHYTHM PATTERN CHARTS

RHYTHM 3

TRACK A

Swing

TIME POINT		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
RHYTHM COUNT		1	&	a	2	&	a	3	&	a	4	&	a	1	&	a	2	&	a	3	&	a	4	&	a
Instrumentation	High Drum										●												●		
	Rim Shot										●												●		
	Cymbal	●			●		●	●			●		●	●			●		●	●		●	●		●
	Cymbal Snub				●		●				●		●				●		●				●		
	Bass Drum	●			●			●			●			●			●			●			●		
Lower Keyboard	Chord	●					●				●						●					●			
	* Accent	●									●						●								
	Chord Sustain																●								
Genie Bass	5th							●			●									●			●		
	Root	●			●									●			●								
Magic Melody	Root				●					●				●					●				●		
	Low 5th			●				●					●												
	Lo 3rd/Lo –3rd	●					●				●			●					●				●		
	Snub			●			●			●			●	●									●		
Swing Bass	8th				●																				
	5th							●					●										●		
	3rd/–3rd										●									●					
	2nd																●								
	Root	●												●											
	Snub												●												

TRACK B

Bosa Nova

TIME POINT		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
RHYTHM COUNT		1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Block	●						●						●								●						●					
	High Drum	●						●						●								●						●					
	Cymbal							●								●								●								●	
	Cymbal Snub							●								●								●								●	
	Brush	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Brush Snub					●		●						●		●						●		●						●		●	
	Bass Drum	●						●		●								●						●		●							
Lower Keyboard	Chord	●				●						●				●				●				●				●		●			
	* Accent	●				●										●								●				●					
	Chord Sustain					●										●				●													
Genie Bass	5th									●																●							
	Root	●						●										●						●									
Magic Melody	Root	●				●										●				●				●									
	Low 5th									●																		●		●			
	Snub																											●					
Swing Bass	8th															●		●												●			
	5th							●		●														●		●							
	Root	●																															
	Snub							●								●								●									

TRACK C

Soft Rock

TIME POINT		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
RHYTHM COUNT		1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Snare									●																●							
	Cymbal																															●	
	Brush	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Brush Snub	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Bass Drum	●				●										●				●				●									
Lower Keyboard	Chord	●				●				●						●				●				●		●				●			
	* Accent									●																●				●			
	Chord Sustain	●				●				●						●										●							
Genie Bass	5th									●																●							
	Root	●				●										●				●				●									
Magic Melody	Root	●				●		●		●						●		●		●				●		●				●			
	Lo 6th/Lo –7th	●				●		●										●		●				●									
	Low 5th									●						●										●							
	Snub					●		●										●		●				●						●			
Swing Bass	8th															●				●				●									
	–7th											●														●							
	5th									●																				●			
	Root	●						●																									
	Snub							●		●														●									

* Accent refers to Lower Keyboard Accent Circuit located on Drawing 8.

RHYTHM PATTERN CHARTS

RHYTHM 4

TRACK A

Country	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	RHYTHM COUNT	1	&	a	2	&	a	3	&	a	4	&	a	1	&	a	2	&	a	3	&	a	4	&	a
Instrumentation	High Drum				●												●								
	Low Drum				●		●										●		●						
	Snare										●												●		
	Brush	●		●	●		●	●		●	●		●	●		●	●		●	●		●	●		●
	Brush Snub				●		●				●		●				●		●				●		●
	Bass Drum	●					●	●						●					●	●					
Lower Keyboard	Chord	●			●		●	●			●		●	●			●		●	●		●	●		●
	* Accent				●		●				●		●				●		●				●		●
	Chord Sustain	●						●						●						●		●			
Genie Bass	5th							●												●					
	Root	●												●											
Magic Melody	Root	●												●											
	Low 5th							●															●		
	Lo 3rd/Lo –3rd	●												●						●					
	Low Root							●									●								
Swing Bass	8th	●																							
	5th							●															●		
	3rd/–3rd																			●					
	Root													●											

TRACK B

Rhumba	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Clave	●						●						●								●				●							
	High Drum	●								●								●								●							
	Low Drum			●		●		●				●				●				●		●		●				●				●	
	Bongo													●																●		●	
	Tom Tom	●																●															
	Brush	●		●	●	●		●		●		●		●		●		●		●	●	●		●		●		●		●		●	
	Brush Snub	●		●	●	●		●		●		●		●		●		●		●	●	●		●		●		●		●		●	
	Bass Drum	●								●				●				●								●				●			
Lower Keyboard	Chord			●				●				●				●				●				●				●				●	
	* Accent			●				●												●				●									
	Chord Sustain			●																●													
Genie Bass	5th									●				●												●				●			
	Root	●																●															
Magic Melody	5th			●										●						●										●			
	3rd/–3rd,				●							●				●					●							●				●	
	Root			●		●				●				●						●		●				●				●			
	Low 5th				●			●				●				●					●			●				●				●	
	Lo 3rd/Lo –3rd					●				●												●				●							
	Low Root							●																●									
Swing Bass	5th													●																●			
	3rd/–3rd									●																●							
	Root	●																●															

TRACK C

Disco	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Snare									●																●							
	Low Drum							●																●						●			
	Cymbal					●								●								●								●			
	Brush	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Brush Snub	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Bass Drum	●								●								●								●							
Lower Keyboard	Chord	●						●		●						●		●		●				●		●				●			
	* Accent							●		●														●		●							
	Chord Sustain	●								●								●								●							
Genie Bass	5th									●																●							
	Root	●																●															
Magic Melody	Root	●								●						●				●				●									
	Lo 6th/Lo –7th							●																		●							
	Low 5th					●								●																●			
	Snub	●				●		●						●						●				●									
Swing Bass	8th	●																●						●									
	6th/–7th																													●			
	5th									●																●							
	Snub																							●									

* Accent refers to Lower Keyboard Accent Circuit located on Drawing 8.

RHYTHM PATTERN CHARTS

RHYTHM 5

TRACK A

Swing Waltz

	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	RHYTHM COUNT	1	&	a	2	&	a	3	&	a	1	&	a	2	&	a	3	&	a
Instrumentation	Snare			●				●					●				●		
	Cymbal	●		●	●		●	●		●	●		●	●		●	●		●
	Cymbal Snub			●			●			●			●			●			●
	Bass Drum	●					●				●								
Lower Keyboard	Chord			●	●			●					●	●			●		
	* Accent				●			●						●			●		
	Chord Sustain							●						●					
Genie Bass	5th										●								
	Root	●					●												
Magic Melody	Root			●				●					●				●		
	Low 5th			●									●						
	Lo 3rd/Lo –3rd							●									●		
	Low Root	●					●				●					●			
	Snub			●			●						●			●			
Swing Bass	8th	●					●												
	5th										●								

TRACK B

Cha Cha

	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Clave	●								●								●								●				●		●	
	Block	●				●				●				●				●				●				●				●		●	
	High Drum					●								●								●								●			
	Low Drum	●		●				●		●		●				●		●		●				●		●		●				●	
	Bongo	●								●								●								●							
	Tom Tom							●								●								●						●		●	
	Brush	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Brush Snub					●		●						●		●						●		●						●		●	
	Bass Drum	●												●				●												●			
Lower Keyboard	Chord	●				●				●				●				●				●				●				●		●	
	* Accent	●								●								●								●							
	Chord Sustain	●				●				●				●				●				●				●							
Genie Bass	5th									●				●												●				●			
	Root	●						●										●						●									
Magic Melody	Root					●																●											
	Lo 6th/Lo –7th																															●	
	Low 5th													●		●														●			
	Lo 3rd/Lo –3rd									●																●							
	Low Root	●																●															
	Snub													●		●														●		●	
Swing Bass	Hi 5th							●																●									
	8th	●																●															
	6th/–7th													●																●			
	5th									●																●							
	Snub							●																●									

TRACK C

March

	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Snare	●				●				●				●				●				●		●		●				●	●	●	●
	Brush	●								●								●								●							
	Bass Drum	●								●								●								●							
Lower Keyboard	Chord	●				●				●				●				●				●		●		●				●		●	
	* Accent					●								●								●								●		●	
	Chord Sustain	●								●								●								●							
Genie Bass	5th									●																●							
	Root	●																●															
Magic Melody	3rd/–3rd																									●							
	Root																	●						●						●			
	Low 5th									●						●						●											
	Lo 3rd/Lo –3rd	●						●						●																			
	Low Root					●																											
	Snub					●		●						●		●						●		●						●			
Swing Bass	8th	●																●															
	6th/–7th																									●							
	5th									●												●								●			

* Accent refers to Lower Keyboard Accent Circuit located on Drawing 8.

RHYTHM PATTERN CHARTS

RHYTHM 6

TRACK A

Waltz

	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	RHYTHM COUNT	1	&	a	2	&	a	3	&	a	1	&	a	2	&	a	3	&	a
Instrumentation	Snare				●			●					●	●			●		
	Cymbal	●									●								
	Bass Drum	●									●								
Lower Keyboard	Chord				●			●					●	●			●		
	* Accent				●			●						●			●		
	Chord Sustain							●									●		
Genie Bass	5th										●								
	Root	●																	
Magic Melody	3rd/–3rd													●			●		
	Root				●			●						●			●		
	Low 5th				●			●					●						
	Lo 3rd/Lo –3rd			●							●								
	Low Root	●																	
	Snub			●	●								●	●					
Swing Bass	5th										●								
	Root	●																	

TRACK B

Latin Rock

	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Clave	●				●				●				●				●				●				●				●			
	Block	●				●				●				●				●				●				●				●			
	High Drum			●		●						●		●						●		●						●		●			
	Low Drum					●		●						●		●						●		●						●		●	
	Snare					●								●								●								●			
	Bongo					●																●											
	Tom Tom													●		●														●			
	Brush	●		●		●		●		●		●		●		●		●		●		●		●		●		●		●		●	
	Brush Snub					●		●						●		●						●		●						●		●	
	Bass Drum	●								●				●				●								●				●			
Lower Keyboard	Chord	●				●				●		●				●		●				●		●		●		●				●	
	* Accent					●						●										●						●					
	Chord Sustain	●				●						●						●				●						●					
Genie Bass	5th									●				●												●				●			
	Root	●																●															
Magic Melody	5th			●		●														●		●											
	3rd/–3rd			●		●														●		●											
	Root													●																●			
	Low 5th													●																●			
	Snub			●																●													
Swing Bass	8th															●																●	
	–7th													●																●			
	5th							●		●														●		●							
	Root	●																●															
	Snub							●								●								●								●	

TRACK C

Metronome

	TIME POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
	RHYTHM COUNT	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a	1	e	&	a	2	e	&	a	3	e	&	a	4	e	&	a
Instrumentation	Clave					●								●								●								●			
	Block	●								●								●								●							
Lower Keyboard	Chord					●								●								●								●			
	* Accent													●																●			
	Chord Sustain					●								●								●								●			
Genie Bass	5th									●																●							
	Root	●																●															
Magic Melody	5th	●																●															
	3rd/–3rd									●																●							
	Root					●																●											
	Low 5th													●																●			
	Snub	●				●				●				●				●				●				●				●			
Swing Bass	5th									●																●							
	3rd/–3rd																	●															
	Root	●																															

*Accent refers to Lower Keyboard Accent Circuit located on Drawing 8.

PARTS INFORMATION

STANDARD PARTS

Replacements for all standard electronic parts and hardware may be purchased directly from local suppliers generally in less time than would be required to obtain them from the factory.

SPECIAL PARTS

In addition to the standard replacement parts, special electronic and mechanical parts are also used. These parts are manufactured by and to the specifications of the factory. Order these parts directly from the factory since they would be difficult or impossible to obtain from other sources.

PARTS ORDERING INFORMATION

When ordering parts be sure to include the following information:

1. Model and Serial Number
2. Part Number
3. A description of the part
4. Specify how you want the part shipped.

Most special electronic parts and mechanical parts will have a part number stamped on them. In the event that the part number is missing, or you are unable to read the part number, a complete description of the part and where it is used will allow the factory to fill your parts order. When parts are ordered in the proper manner the factory is able to fill your orders promptly—delays that might result are avoided.

ADDRESS PARTS ORDERS TO:

LOWREY SERVICE PARTS DEPARTMENT
1300 Naperville Drive
Romeoville, Illinois 60441

IMPORTANT

IN ANY CORRESPONDENCE CONCERNING THIS INSTRUMENT ALWAYS INCLUDE MODEL AND SERIAL NUMBERS

PARTS LIST

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THE PARTS LIST CONTAINS THE FOLLOWING INFORMATION:

1. Name of Part
2. Value, Tolerance and Code (When Important)
3. Brief description
4. Where the part is found (assembly, printed circuit board, etc.)
5. Schematic Reference Number
6. PART NUMBER — USE IT!

This parts list includes all standard stock replacement parts. No attempt has been made to include every nut, bolt and screw. If the necessity for a non-listed part arises, please write describing the parts location and function as well as model and serial number of the unit.

PARTS LIST

BOARD A
Tone Generator

Capacitor	Electrolytic	
C1	100 uf 16V	945-026783-006
Coil		
L1	Oscillator	952-018874-002
Diodes		
D1		919-024117
All others		919-024769
Integrated Circuits		
IC1-12	Divider	991-028681-001
IC13	TOS	991-027326
IC14	Hex Inverter	991-027359-002
Network		949-024536
Sockets	14-Pin	906-018905
	16-Pin	906-018905-001

BOARD B
Upper/Lower Diode Keying

Diodes		
All		919-024769
Networks	14-Pin	949-022779
	8-Pin	949-022778

BOARD C
Upper 2- & 2-2/3 Foot Diode Keying

Diodes		
All		919-024769
Networks	14-Pin	949-022779
	8-Pin	949-022778

BOARD D
Keyer Control & AOC

Capacitors	Electrolytic	
	2.2 uf 25V	945-026783-001
	47 uf 25V	945-026783-021
Diodes		
All		919-024769
Potentiometer		
VR1	5K 20%	925-004399-005

BOARD D (Continued)

Transistors	
Q1-41	991-010098
Q42-85	991-010098-004
Q86	991-020425-001
Q87	991-026315
Q88	991-010098
Q89	991-026315
Q90	991-010098
Q91	991-026315
Q92	991-010098
Q93	991-026315
Q94	991-010098
Q95	991-026315
Q96	991-010098
Q97	991-026315
Q98	991-010098
Q99	991-026315
Q100	991-010098
Q101	991-026315
Q102	991-010098
Q103	991-026315
Q104	991-010098
Q105	991-026315
Q106	991-010098
Q107	991-026315
Q108	991-010098
Q109	991-026315
Q110	991-010098
Q111	991-002232
Q112	991-010098

BOARD E
Upper/Lower Flute & String Collectors

Capacitors	Electrolytic	
	1 uf 50V	945-026783-014
	2.2 uf 16V	945-028285-002
Diodes		
All		919-024769
Integrated Circuits		
IC1-3	Quad Op-Amp	991-022794
Socket	14-Pin	906-018905
Transistors		
Q8-28		991-018238
Q30-32		991-028269
Q33, 34		991-026315
Q35, 37		991-028269
Q38		991-010098
Q39		991-028269
Q40		991-010098

PARTS LIST

BOARD F
Upper Flute & String Collectors

Capacitors	Electrolytic	
C1	470 uf 16V	945-026783-011
C7	100 uf 16V	945-026783-006
C14	470 uf 16V	945-026783-011
	1 uf 50V	945-026783-014
	2.2 uf 16V	945-028285-002
Diodes		
All		919-024769
Integrated Circuits		
IC1, 2	Quad Op-Amp	991-022794
Photocell		
P1		948-022782
Socket	14-Pin	906-018905
Transistors		
Q1-21		991-018238
Q22		991-028269
Q23-29		991-028269
Q36		991-026315-002
Q37		991-028269
Q38		991-010098

BOARD G
Lighted Button Logic

Capacitor	Electrolytic	
C1	100 uf 16V	945-026783-006
Diodes		
All		919-024769
Integrated Circuits		
IC1	Quad NOR	991-026025-001
IC2	Hex Inverter	991-027359-002
IC3	Quad NOR	991-026025-001
IC4	Hex Inverter	991-027359-002
IC5	Quad NOR	991-026025-001
IC11	Hex Inverter	991-027359-002
IC13, 14	Quad NOR	991-026025-001
IC15	Quad NAND	991-025515-001
Socket	14-Pin	906-018905
Transistors		
Q1-12		991-016727
Q26, 30		991-016727
Q31		991-002232
Q32		991-016727
Q33		991-010098

BOARD H
Upper/Lower Reed/String QC

Capacitors	Electrolytic	
C2-4	100 uf 16V	945-026783-006
	2.2 uf 16V	945-028285-002
	3.3 uf 16V	945-028285-001
	Tantalum	
	2.2 uf 35V	946-012624-225
Diodes		
All		919-024769
Integrated Circuits		
IC1-3	Op-Amp	991-021444-001
IC4	Quad Op-Amp	991-025267
IC5	Op-Amp	991-021444-001
Potentiometers		
VR1, 2	50K 20%	925-004349-007
Sockets	8-Pin	906-021448
	14-Pin	906-018905
Transistors		
Q1, 2		991-026617
Q3, 4		991-028269
Q5		991-018238
Q6, 7		991-028269
Q8		991-026617
Q9, 10		991-028269
Q11		991-026617
Q12, 13		991-028269
Q14		991-018238
Q15, 16		991-028269
Q17		991-010098
Q18		991-026617
Q19		991-028269
Q20		991-026617
Q21, 22		991-028269
Q23		991-026617
Q24		991-028269
Q25		991-018238
Q26, 27		991-026315-002
Q28		991-018238
Q29, 30		991-028269
Q31		991-018238
Q32		991-028269
Q33		991-010098
Q34, 37		991-026617

BOARD J
DC Control

Capacitors	Electrolytic	
	10 uf 16V	945-026783-004

PARTS LIST

BOARD J (Continued)

DC Control

Capacitors	Electrolytic	
C1, 2	100 uf 16V	945-026783-006
	Tantalum 35V	
	10 uf	946-021452-005
	2.2 uf	946-012624-225
Diodes		
Z1	Zener 10V	919-017406-057
All others		919-024769
Integrated Circuits		
IC1	Dual Op-Amp	991-029888
IC2, 3	Quad NOR	991-026025-002
Potentiometers		
VR1	50K 20%	925-004349-007
VR2	10K 20%	925-004349-003
Resistor	WW 10%	
	22 Ohm 2W	924-010471-220
Sockets	14-Pin	906-018905
	8-Pin	906-021448
Transistors		
Q1, 3, 4		991-026315-002
Q5		991-013544
Q6		991-026617
Q7		991-026315-002
Q8		991-026617
Q9-12		991-026315-002
Q13		991-010098
Q14, 15		991-026315-002
Q16, 18		991-010098
Q19		991-026315-002
Q20		991-026617
Q21		991-026315-002
Q23-26		991-026315-002
Q27		991-020426-001
Q28		991-020425-001
Q29		991-026315-002
Q31-33		991-026315-002

BOARD K

Output Mixer

Capacitors	Electrolytic	
C1,2,5,6	100 uf 16V	945-026783-006
	4.7 uf 35V	945-026783-003
	2.2 uf 16V	945-028285-002
	1 uf 50V	945-026783-014

BOARD K (Continued)

Diodes		
D4	Triple	919-010454-001
All others		919-024769
Integrated Circuits		
IC2	Quad Op-Amp	991-022794
IC3, 4	Op-Amp	991-021444-001
IC5	Quad Op-Amp	991-022794
IC7	Op-Amp	991-021444-001
Sockets	8-Pin	906-021448
	14-Pin	906-018905
Transistors		
Q4		991-026315-002
Q5		991-026617
Q6, 7		991-026315-002
Q9		991-026617
Q11		991-026617

BOARD L

Chorus

Capacitors	Electrolytic	
C2	100 uf 16V	945-026783-006
	220 uf 15V	945-026783-012
	10 uf 16V	945-026783-004
C4	47 uf 25V	945-026783-021
Diodes		
All		919-024769
Integrated Circuits		
IC1, 2	Dual Op-Amp	991-025244
IC3, 4	Bucket Brigade	991-028690
IC5	Dual Op-Amp	991-025244
Potentiometers		
VR1, 2	5K 20%	925-004349-005
Socket	8-Pin	906-021448
Transistors		
Q1, 2		991-016727
Q3 - 6		991-028691
Q7 - 10		991-026315-002

BOARD P

Rhythm Logic

Capacitors	Electrolytic	
C1	100 uf 16V	945-026783-006
	1 uf 50V	945-026783-014

PARTS LIST

BOARD P (Continued)

Rhythm Logic

Capacitors	Electrolytic	
C8	4.7 uf 16V	945-026783-002
C14	10 uf 16V	945-026783-004
	Tantalum	
	4.7 uf 35V	946-012624-475

Diodes		
Z1	Zener 3.3V	919-017406-018
Z2, 3	Zener 10V	919-017406-057
All others		919-024769

Integrated Circuits		
IC1	ROM 1	920-028662
IC2	Hex D Flip-Flop	991-028685-001
IC3	Dual 4-Bit Shift Register	991-026609
IC4	Phase Locked Loop	991-028683-001
IC5	Quad NOR	991-026025-001
IC6	Quad OR	991-025516
IC7	Quad AND	991-025517
IC8	Hex Buffer	991-028686
IC9	Bass Note Select	991-028689-001
IC10	TOS	991-027326
IC11	Dual Flip Flop	991-027358-001
IC12	Dual AND/OR Invert	991-026613
IC13	Quad AND	991-025517
IC14	ROM 2	920-028675
IC15	Priority Encoder	991-025599
IC16	Triple 3 Input AND	991-028684-001
IC17	Dual AND/OR Invert	991-026613
IC18	Quad AND/OR	991-028680-001
IC19	Hex Inverter	991-027359-002
IC20	Quad NOR	991-026025-001
IC21	Hex Inverter	991-027359-002
IC22	Quad AND	991-025517
IC23	Dual Flip-Flop	991-027358-001
IC24	Quad OR	991-025516
IC25	Hex Inverter	991-027359-002
IC26	Quad NAND	991-025515
IC27	RFG	920-028273
IC28	Quad AND	991-025517
IC29	Dual Flip-Flop	991-027358-001

Sockets	28-Pin	906-018905-003
	24-Pin	906-018905-002
	16-Pin	906-018905-001
	14-Pin	906-018905

BOARD P (Continued)

Transistors		
Q1		991-010098
Q2		991-026617
Q3, 5		991-010098
Q6		991-013544
Q7, 8		991-026617
Q9-15		991-026315-002
Q16-22		991-026315
Q23-29		991-010098

BOARD R

CFG & Pedal

Capacitor	Electrolytic	
C3	100 uf 16V	945-026783-006

Coil		
L1	Oscillator	952-018874-004

Diodes		
D7		919-024117
All others		919-024769

Integrated Circuits		
IC5	Pedal Latch	920-028630
IC6	33-Bit Converter	991-022793
IC7	Hex Inverter	991-027359
IC9	Triple 3 Input NOR	991-028682-001
IC10	Dual AND/OR Inverter	991-026613
IC11	Hex Inverter	991-027359
IC12	Quad NAND	991-025515
IC14	Hex Buffer	991-028650-001
IC15	CFG	991-026003-002
IC16	Dual Flip Flop	991-027358-001
IC20	Hex Buffer	991-028650-001
IC21, 22	Dual Flip Flop	991-027358-001
IC24, 25	Quad OR	991-025516

Potentiometer		
VR1	10K 20%	925-004349-003

Sockets	40-Pin	906-022727
	24-Pin	906-018905-002
	16-Pin	906-018905-001
	14-Pin	906-018905

Transistor		
Q1		991-018238

PARTS LIST

BOARD S
Instrumentation

Capacitors	Electrolytic	
	2.2 uf 16V	945-028285-002
	2.2 uf 25V	945-026783-001
	4.7 uf 16V	945-026783-002
C1, 5, 9, 10	100 uf 16V	945-026783-006
	2 uf 20V	945-008895-032
Diodes		
D45-48		919-010873
All others		919-024769
Integrated Circuits		
IC1-6	Quad Op-Amp	991-022794
IC7-9	Dual Flip-Flop	991-027358-001
IC10	Noise Generator	991-024108
Sockets	14-Pin	906-018905
	8-Pin	906-021448
Transistors		
Q7		991-018238
Q8		991-028269
Q9, 10		991-026315-002
Q11, 12		991-018238
Q13, 14		991-026315-002
Q15, 16		991-018238
Q17		991-026315-002
Q18, 19		991-018238
Q20		991-026315-002
Q21		991-026617
Q22		991-026315-002
Q23		991-018238
Q24-26		991-026617
Q27, 28		991-026315-002
Q29, 30		991-026617
Q31		991-018238
Q32, 33		991-026315-002
Q36		991-018238

BOARD T
Amplifiers

Capacitors	Electrolytic	
	2.2 uf 63V	945-026783-017
	4.7 uf 63V	945-026783-018
	10 uf 100V	945-026783-020
	22 uf 63V	945-026783-019
Clip	Fuse	976-026063

BOARD T (Continued)

Diodes		
D1, 2		919-024769
Fuse	3-Amp Fast-Blo	939-001197-003
Transistors		
Q1, 2		991-026617
Q3		991-015614
Q4		991-013544
Q10		991-026617

BOARD V
Crossover

Capacitors	Electrolytic	
	100 uf 35V	945-026783-007
C1, 2	100 uf 16V	945-026783-006
	3.3 uf 16V	945-028285-001
Diodes		
D1		919-010623
D2, 3		919-004799
Integrated Circuit		
IC2	Dual Op-Amp	991-025244
Potentiometers		
VR1	25K 20%	925-004349-006
VR2	500K 20%	925-004349-008
Relay		
RL1	4-PDT	921-024167
Resistors	WW 10%	
	150 ohm 2W	924-010471-151
	47 ohm 2W	924-010471-470
Socket	8-Pin	906-021448
Transistors		
Q12		991-026617
Q14		991-026315-002
Q16		991-026617
Q17, 19		991-018238
Q21		991-026617

BOARD W
Regulator

Capacitors	Electrolytic	
C1	100 uf 16V	945-026783-006
C2, 3	22 uf 35V	945-026783-009

PARTS LIST

BOARD W (Continued)

Diode		
Z1	Zener 15V	919-026799-068
Integrated Circuit		
IC3	Neg. 15V Reg.	992-026646-009
Resistor	WW 10%	
R1	5 ohm 5W	924-008896-046

BASS PEDAL ASSEMBLY

Assemblies	Long Pedal	997-006405
	Short Pedal	997-006406
Caps	Black	915-003863
	Dark Brown	915-003856
Springs	Compression	975-005811
	Contact	917-009155
	Buss Bar	918-002342
	Contact Buss	918-009995

BENCH ASSEMBLY

Bench	Walnut	978-028695

CONSOLE ASSEMBLY

Back		972-029200
Endblocks	Lower LH.	978-028632-001
	Lower RH.	978-028633-001
	Upper LH.	978-028634-001
	Upper RH.	978-028635-001
Lamp	Bass Pedal GE70	939-026038-004
Leg	Walnut	978-028694-001
Lens	Bass Pedal	922-029251
Rail	Upstop	936-028268-006
Sockets	Aux. Input/Output	995-028579
	Bass Pedal Lamp	906-029256
Spring	Reverb Unit	984-017447
Speakers		
Bass	10-inch 8 ohm	985-024183
Main 1,2	8-inch 8 ohm	985-003185-004

POWER SUPPLY CHASSIS

Arm	Actuator	967-026076
Assemblies	Control Arm	
	Expression Pedal/ Glide Switch	997-029491
	Glide Switch	997-029492
	Minor Switch	997-029494
	Pedal & Mat	997-023127
	Power Supply	997-029421
Bulb	GE1819	939-003190
Capacitors	Electrolytic	
	2200 uf 63V	945-026797-004
	2200 uf 35V	945-026797-006
	470 uf 63V	945-026797-005
Cord	Power	989-008717
Diffuser	Clear	922-015938
Diodes		
D1	Bridge Rectifier 6-Amp	919-022736-003
D2	Bridge Rectifier 30-Amp	919-029090
Fuse	3-Amp Slo-Blo Pigtail	939-001120-008
Integrated Circuits		
IC1, 2	+15V Reg.	992-024149-010
Light	Shield	922-026077
Mats	Expression Pedal	959-022953
	Glide & Minor Lower	959-009208-003
	Glide & Minor Upper	959-009208-004
Photocell	Expression Pedal	948-029970
Resistors	WW 10%	
	1 ohm 2W	924-008896-047
	15 ohm 5W	924-008896-001
	1500 ohm 5W	924-008896-014
	.18 ohm 2W	924-008896-021
	.18 ohm 5W	924-008896-029
Springs	Glide Switch	975-022949
	Compression	975-011747-001
	Contact Glide/ Minor	917-029542

PARTS LIST

POWER SUPPLY CHASSIS (Continued)

Transformers		
T1	Power 120V	954-029504
Transistors		
Q5		992-026039-002
Q6		992-026040-002
Q9		991-026315-001

TAB PANEL ASSEMBLY

Assembly	Mechanical Tabswitch	997-029461
Clip	Lamp Retainer	976-028699
Guide	Slider	976-005170-001
Jack	Headphone	910-028601
Knobs	Blue Variegated	915-026335-003
	Gray Variegated	915-026335-006
	Green Variegated	915-026335-005
Lamps	Tab Panel, Lighted Presets GE73	939-026038-002
Lens	**Pushbutton**	
	Clear	922-027397-010
	Green	922-027397-005
	Red	922-027397-002
	White	922-027397-009
	Yellow	922-027397-004

Potentiometers (20% unless otherwise specified)

Reverb Length	10K Log.	925-028619-003
Rhythm Balance	Dual 10K Linear.	925-029503-002
Rhythm Speed	1 Meg Log 25%	925-028619-002
Rhythm Volume	Dual 10K Log.	925-029503-001
Sustain Organ	10K Lin.	925-028619-001

Pusher	Medium	964-025555
Socket	Lamp	906-028617
Springs	Contact	917-005166-004
	Toggle	975-025543
Switches	Pushbutton	960-029224
	Power 120V	960-028213
	Track Select	960-027322

TAB PANEL ASSEMBLY (Continued)

Tabs	AOC	915-025544-005
	Banjo	915-025544-014
	Bass Full	915-025544-048
	Bass Medium	915-025544-049
	Clarinet 16	915-025544-091
	Cornet 16	915-025544-110
	Flutes	915-025544-104
	Flute 2	915-025544-034
	Flute 2-2/3	915-025544-035
	Flute 4	915-025544-036
	Flute 8	915-025544-038
	Flute 16	915-025544-039
	Genie String Bass	915-025544-051
	Guitar	915-025544-045
	Guitar Bass	915-025544-116
	Kinura 8	915-025544-040
	Lower Full	915-025544-090
	Lower Medium	915-025544-093
	Magic Genie Chords	915-025544-032
	Magic Melody Piano	915-025544-099
	Magic Swing Bass	915-025544-107
	Main	915-025544-117
	Pedal 16/8	915-025544-098
	Pedal Sustain	915-025544-057
	Piano	915-025544-017
	Repeat	915-025544-061
	Rhythm 1	915-025544-084
	Rhythm 2	915-025544-085
	Rhythm 3	915-025544-086
	Rhythm 4	915-025544-087
	Rhythm 5	915-025544-088
	Rhythm 6	915-025544-089
	Rhythm Start Auto	915-025544-047
	Trombone 16	915-025544-042
	Vibrato	915-025544-006
	Viola 8	915-025544-022
	Violina 4	915-025544-021

UPPER/LOWER KEYSWITCH ASSEMBLY

Actuators	Keyswitch	964-026765
Clip	Spring	976-009364-002
Coil	70MH	956-018877
Keys	Black	964-024757
	White A	964-028228-001
	White B	964-028228-002
	White C	964-028228-003

UPPER/LOWER KEYSWITCH ASSEMBLY (Continued)

Keys	White D	964-028228-004
	White E	964-028228-005
	White F	964-028228-006
	White G	964-028228-007
	White A1 Lower Keyboard....	964-028228-008
	White C4 Upper Keyboard....	964-028228-009
Springs	Pulldown	975-027466
	Contact	917-022999
Wire	Keyswitch Actuator	976-029969

NOTE: Keys are supplied without wire actuators. Insert wire actuator from original key into replacement key. If new actuators are needed, they should be ordered separately.

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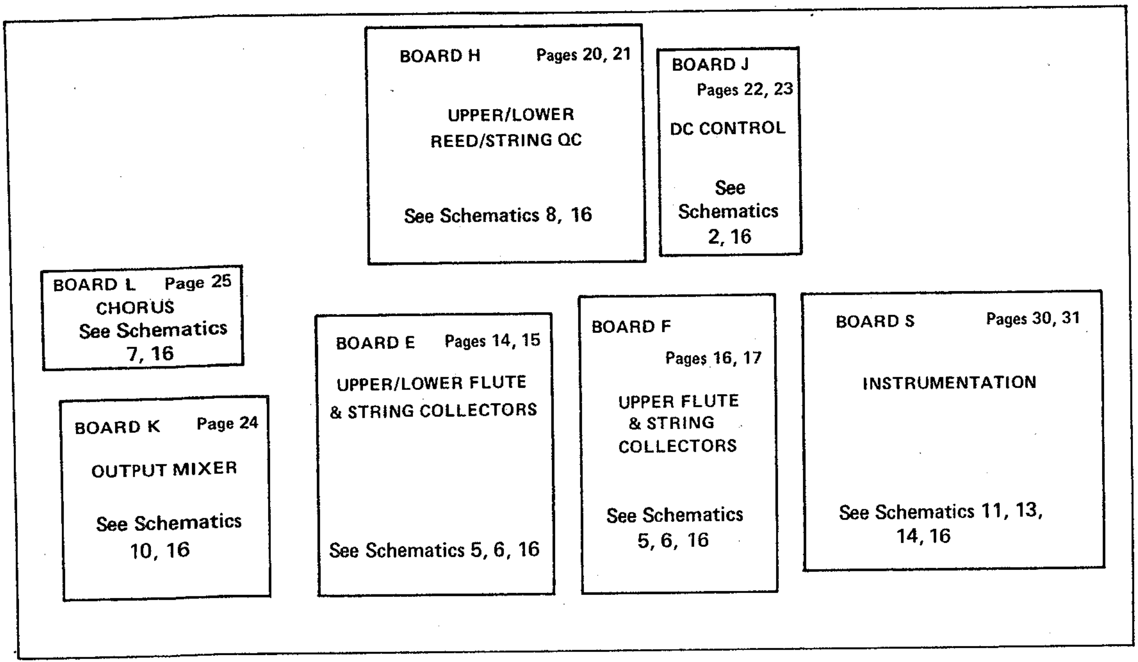
BOARD H Pages 20, 21
UPPER/LOWER REED/STRING QC
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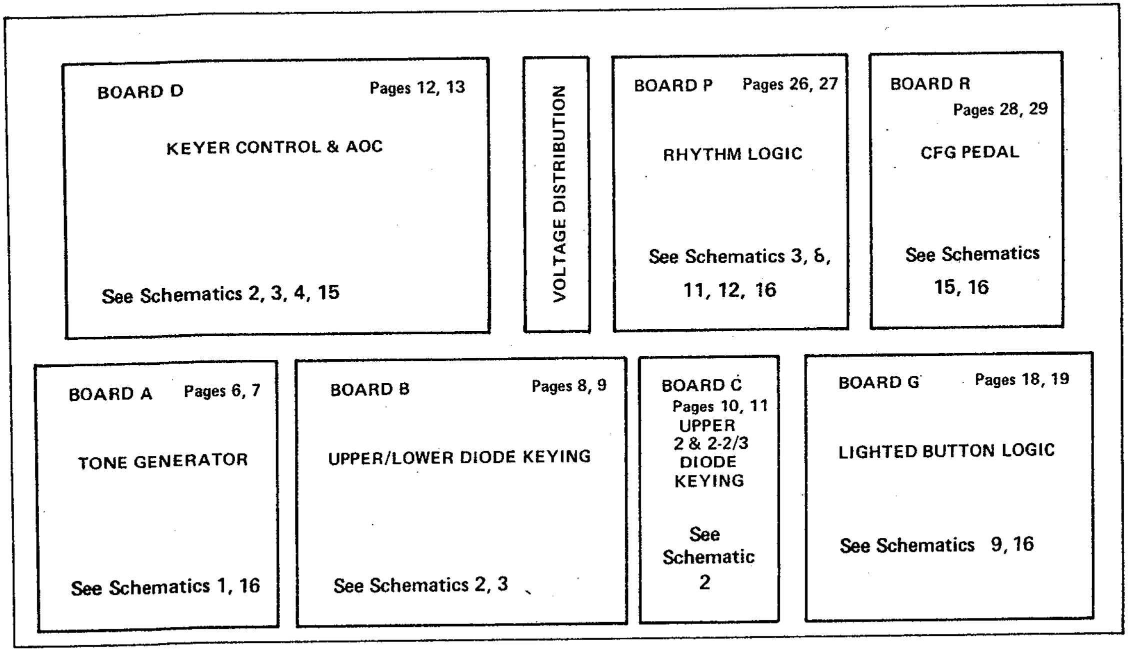
TRAY UP

M525 BOARD LOCATION

TRAY DOWN


BOARD D Pages 12, 13
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BOARD P Pages 26, 27
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UPPER/LOWER DIODE KEYING
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UPPER 2 & 2-2/3 DIODE KEYING
See Schematic 2
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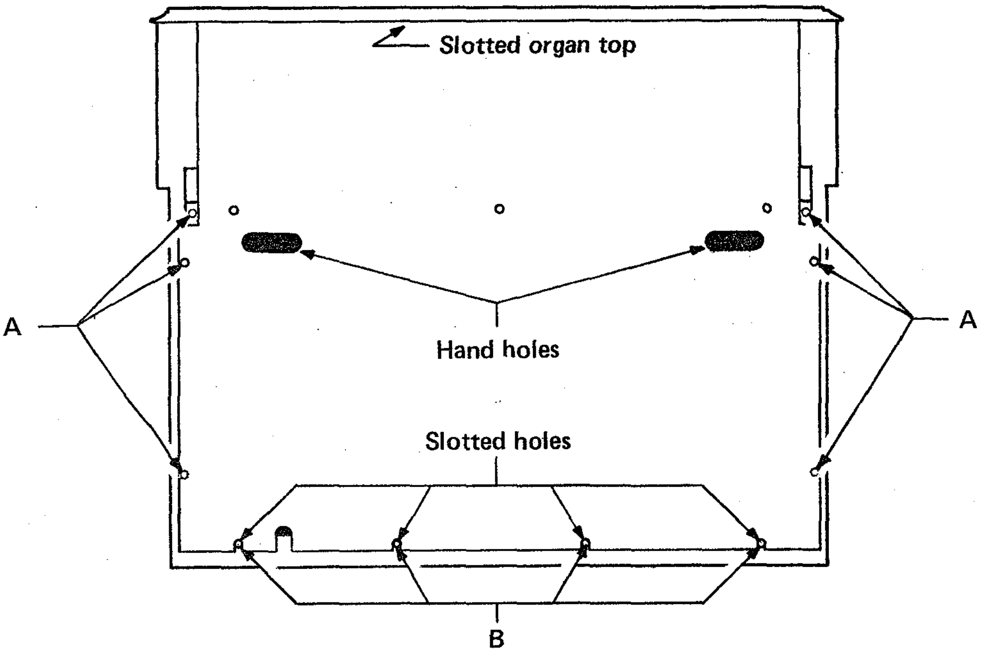
BOARD T, Page 32 – AMPLIFIERS – See Schematics 16, 17 } Located in Power Supply Chassis
BOARD W, Page 34 – REGULATOR – See Schematic 16
BOARD V, Page 33 – CROSSOVER – See Schematics 10, 16, 17 – – – Located on Top of Power Supply Chassis

BACK OF ORGAN



To remove back:

1. Remove screws marked A.
2. Loosen screws marked B.
3. Grip organ back through hand holes and pull toward you until top of organ back is removed from slot in top of organ.
4. Raise organ back until slotted holes at bottom of organ back are clear of screws.

To replace back:

1. Slide slotted holes at bottom of organ back over screws marked B.
2. With hands in hand holes, bend top of organ back forward and insert it in slotted organ top.
3. Replace screws marked A. Tighten screws marked B.

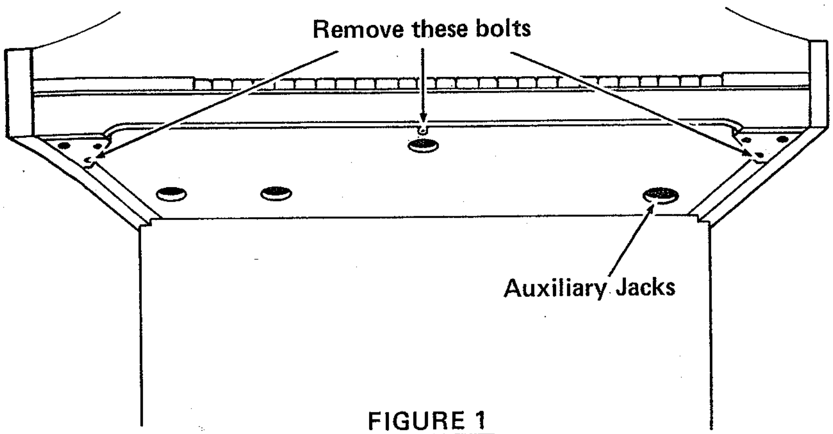

Remove these bolts
Auxiliary Jacks

FIGURE 1

TRAY ASSEMBLY REMOVAL

1) Remove organ back.
2) Unfasten any cables that are attached to inside of cabinet walls (i.e. power supply cables).
3) Remove bolts located under front keybed (see Figure 1).
4) Remove two bolts from brackets on left and right sides of circuit board tray (Figure 2).
5) Slide tray assembly toward rear of organ.

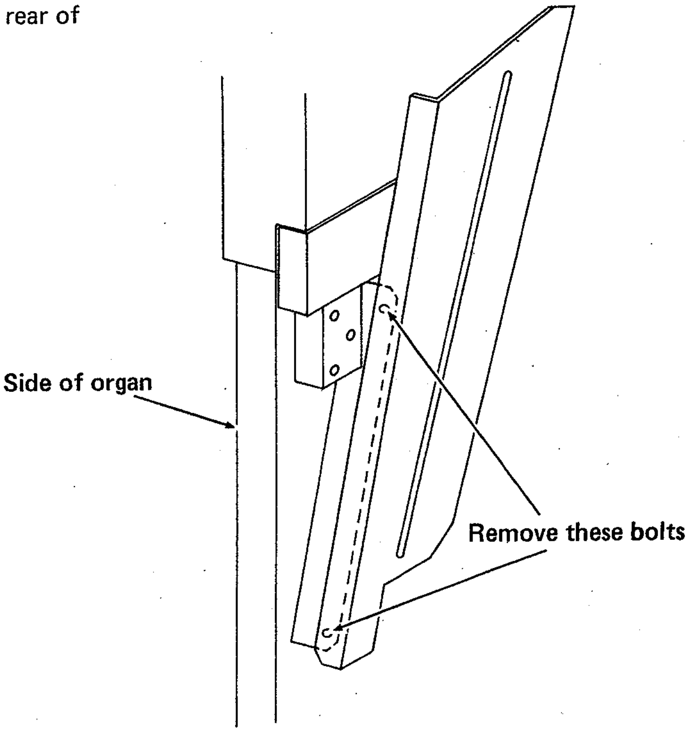

Side of organ
Remove these bolts

FIGURE 2

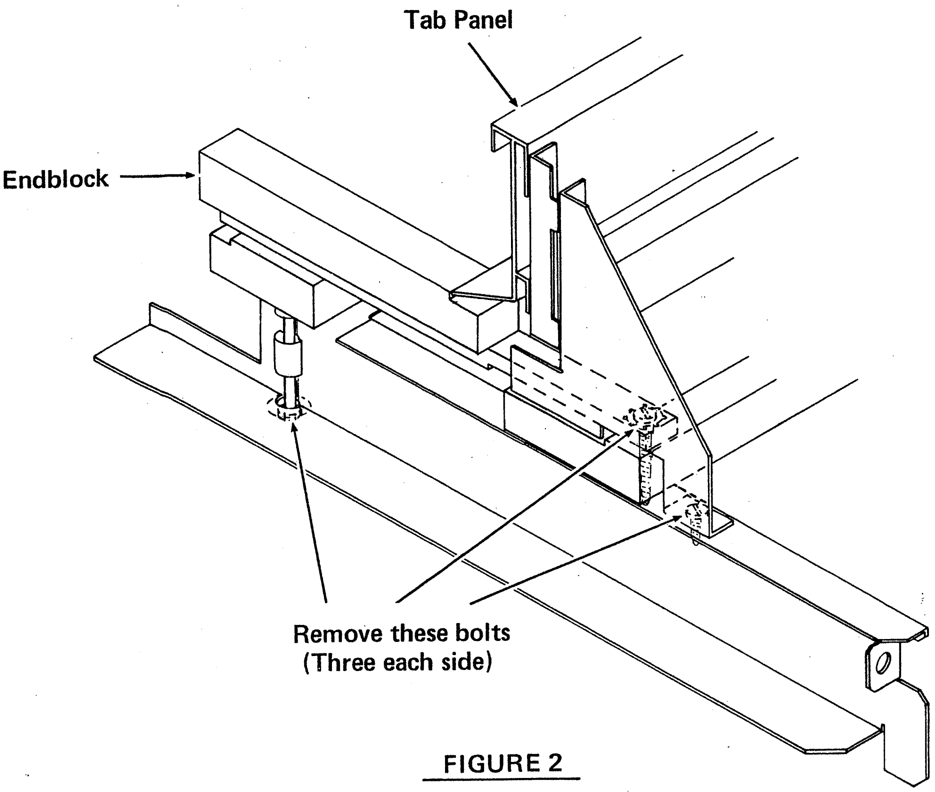


FIGURE 2

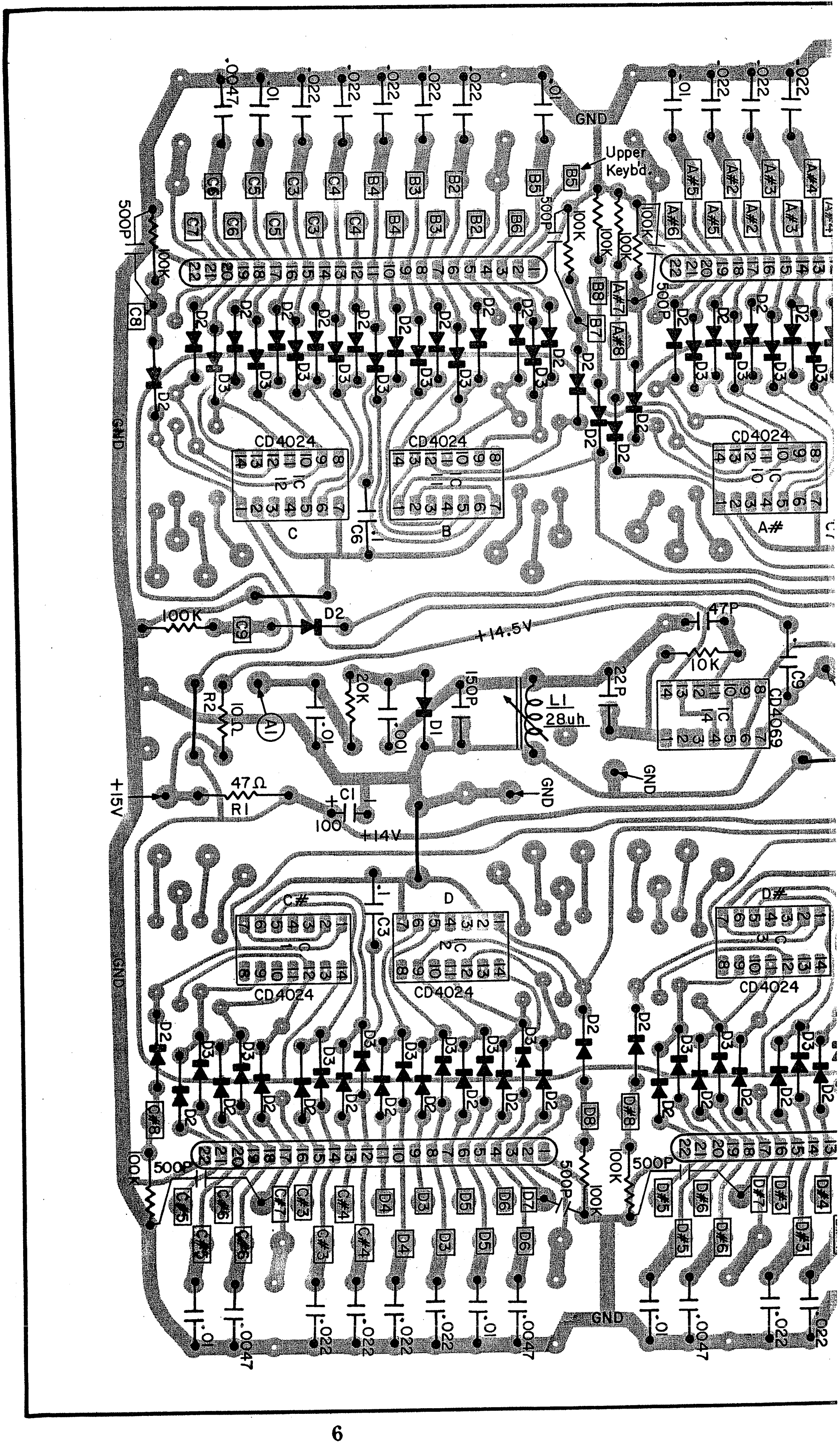
ACCESS TO LOWER KEYSWITCH CONTACTS

1) Lower circuit board tray assembly
2) Remove three bolts from the left and right tab rail brackets (see Figure 2)
3) Slide upper keyboard toward rear of organ

TAB REPLACEMENT

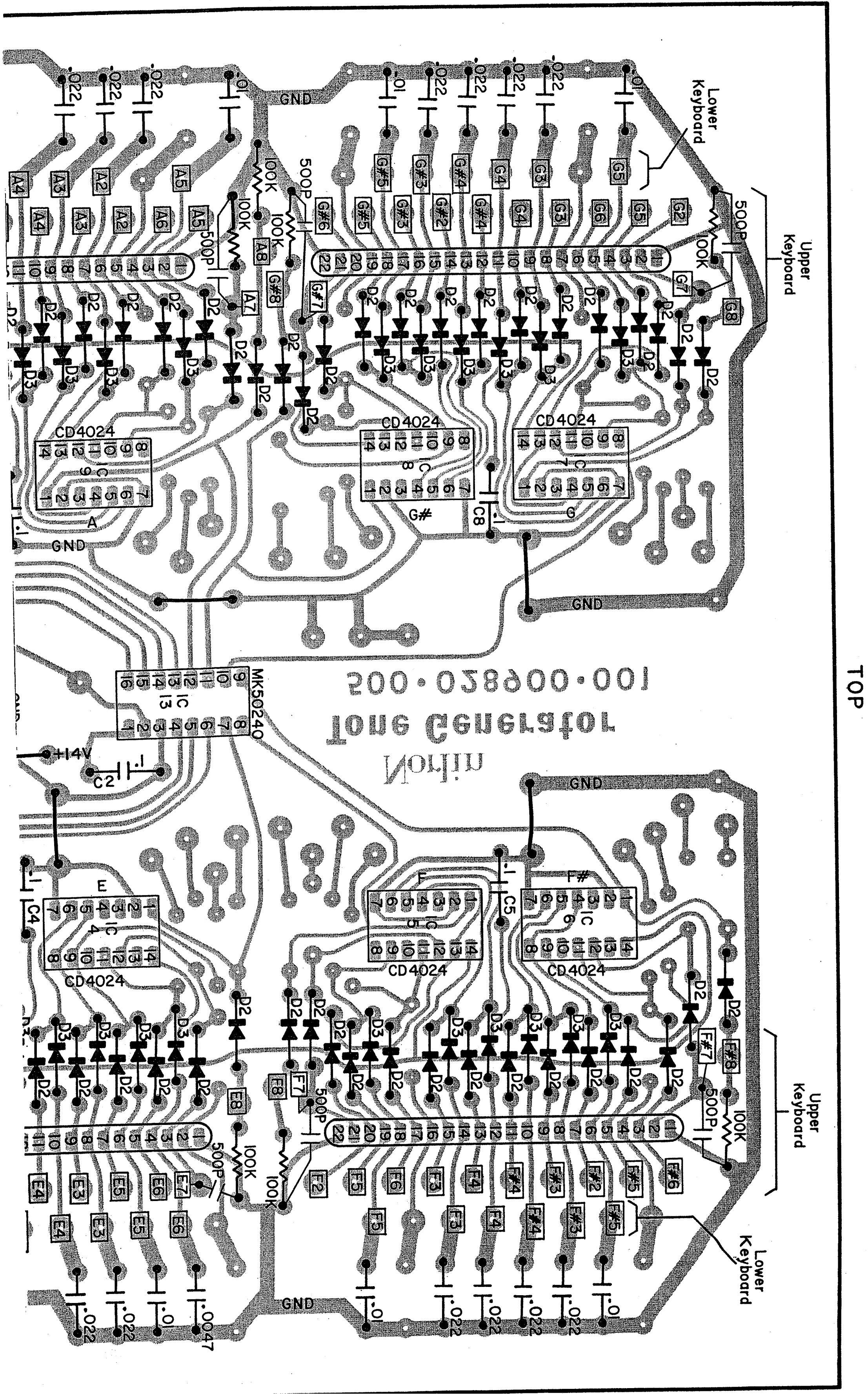
1) Slide tray assembly out of cabinet
2) Grasp tab and apply steady upward pressure to release tab from pivot rod
3) Loosen tabswitch assembly
4) Remove and replace tab
5) Apply steady downward pressure until tab snaps onto pivot rod
6) Check tab for proper operation
7) Tighten tabswitch assembly

BOARD "A"

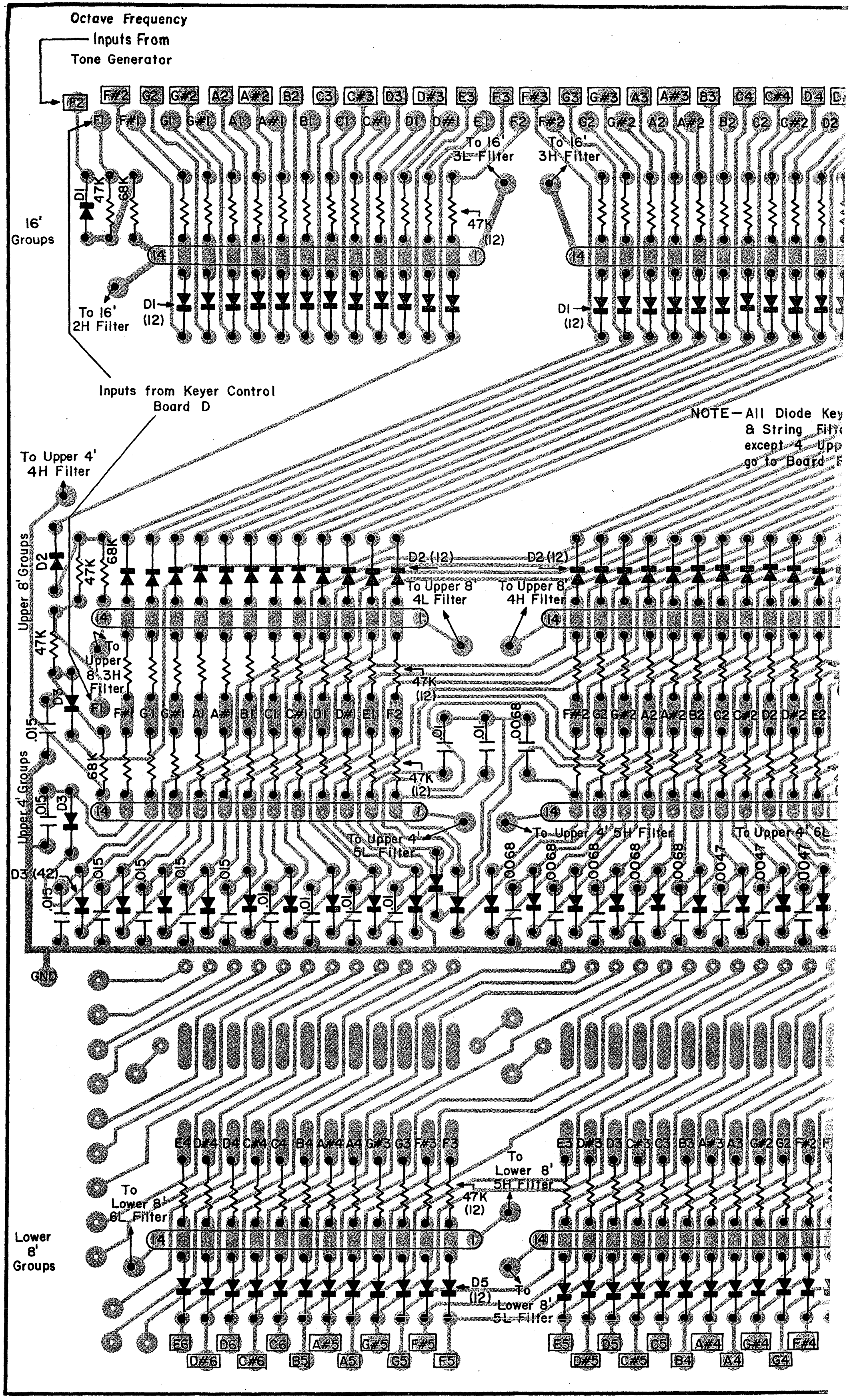


GND
Upper Keybd
CD4024
CD4069
IC
C
B
A#
C#
D
D#
+14.5V
+15V
+14V
L1
28uh
47Ω
R1
R2
10Ω
A1
C1
100
100K
10K
20K
150P
22P
47P
500P
.0047
.01
.022
.001
D1
D2
D3
C6
C3
C9
C8
D8
D#8
B8
B7
A#7
A#8

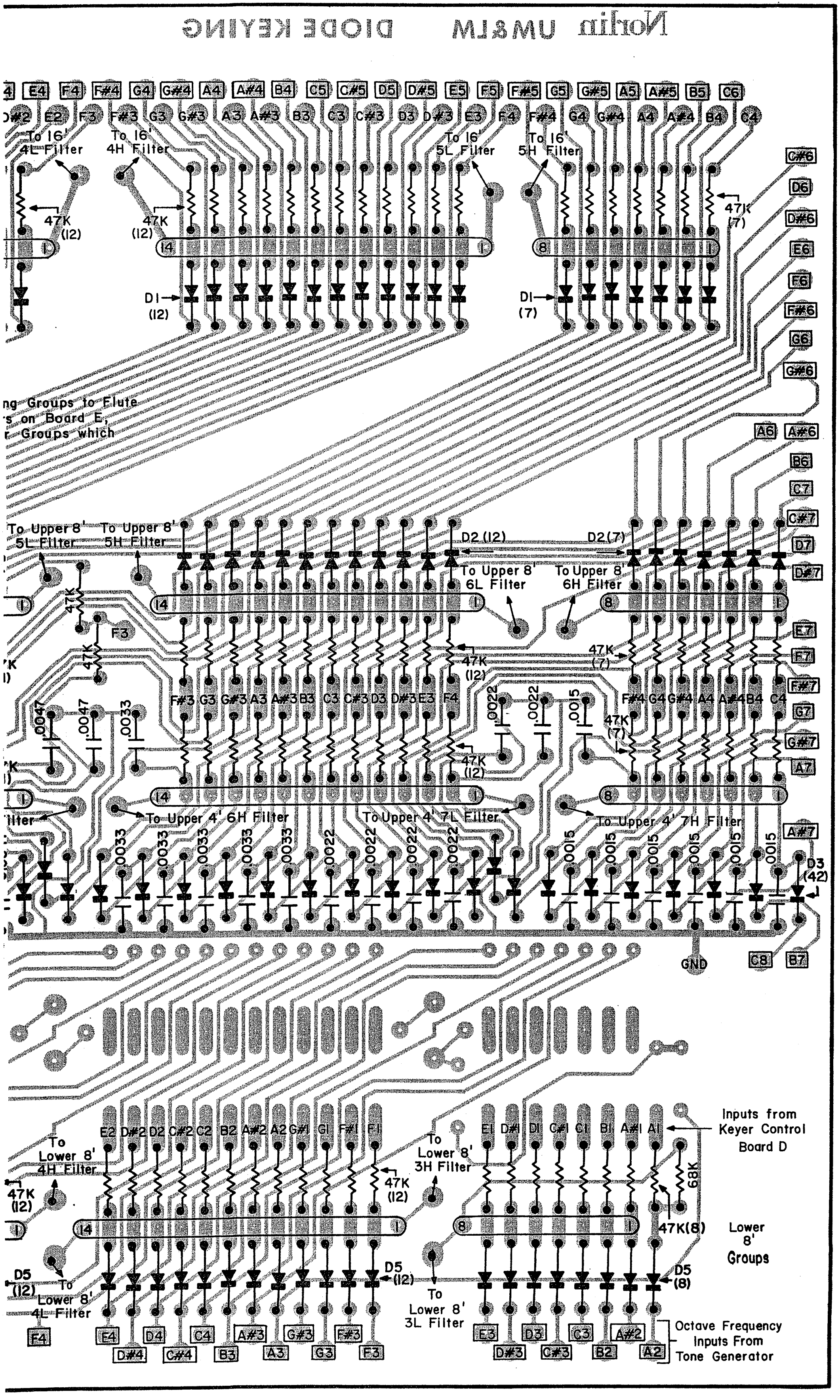
TONE GENERATOR


TOP
Upper Keyboard
Lower Keyboard
GND
CD4024
MK50240
IC 13
+14V
C2
C4
C5
C8
500·028600·001
Tone Generator
Norlin
A
G#
G
E
F
F#
D2
D3
100K
500P
.022
.01
.0047
.1

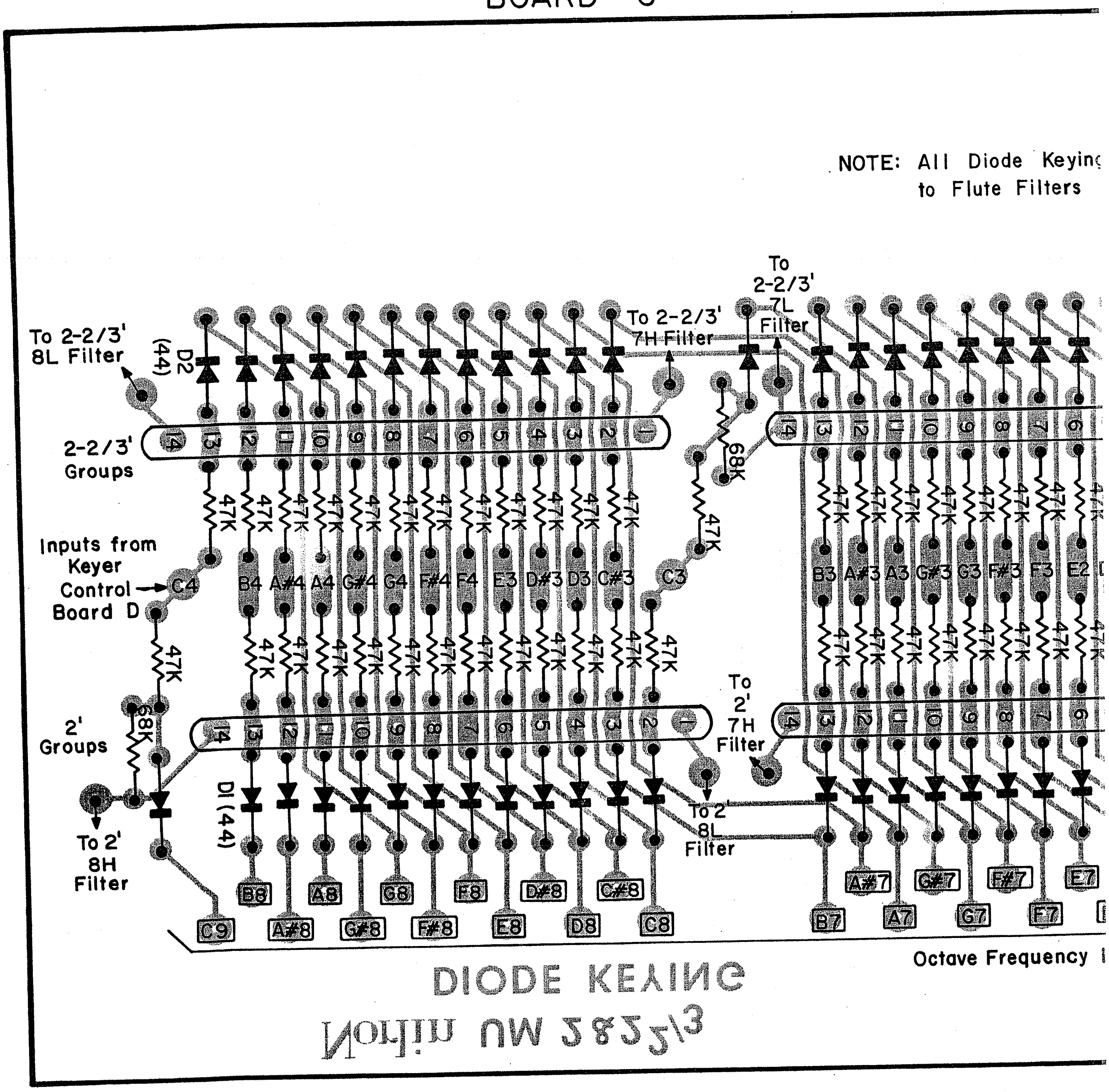
TOP BOARD "B" UPPER/


Octave Frequency
Inputs From
Tone Generator
F2
F#2 G2 G#2 A2 A#2 B2 C3 C#3 D3 D#3 E3 F3 F#3 G3 G#3 A3 A#3 B3 C4 C#4 D4
F1 F#1 G1 G#1 A1 A#1 B1 C1 C#1 D1 D#1 E1 F2 F#2 G2 G#2 A2 A#2 B2 C2 C#2 D2
To 16' 3L Filter
To 16' 3H Filter
D1
47K
68K
47K (12)
16' Groups
14
1
To 16' 2H Filter
D1 (12)
Inputs from Keyer Control Board D
NOTE—All Diode Key
& String Filt
except 4 Upp
go to Board
To Upper 4' 4H Filter
Upper 8' Groups
D2
47K
68K
D2 (12)
To Upper 8' 4L Filter
To Upper 8' 4H Filter
To Upper 8' 3H Filter
47K
D3
F1 F#1 G1 G#1 A1 A#1 B1 C1 C#1 D1 D#1 E1 F2
F#2 G2 G#2 A2 A#2 B2 C2 C#2 D2 D#2 E2
47K (12)
.01
.01
.0068
.015
68K
Upper 4' Groups
.015
D3
To Upper 4' 5L Filter
To Upper 4' 5H Filter
To Upper 4' 6L
D3 (42)
.015
.015
.015
.015
.015
.01
.01
.01
.01
.0068
.0068
.0068
.0068
.0068
.0047
.0047
.0047
GND
E4 D#4 D4 C#4 C4 B4 A#4 A4 G#3 G3 F#3 F3
E3 D#3 D3 C#3 C3 B3 A#3 A3 G#2 G2 F#2
To Lower 8' 5H Filter
47K (12)
To Lower 8' 6L Filter
Lower 8' Groups
D5 (12)
To Lower 8' 5L Filter
E6 D6 C6 A#5 G#5 F#5 E5 D5 C5 A#4 G#4 F#4
D#6 C#6 B5 A5 G5 F5 D#5 C#5 B4 A4 G4

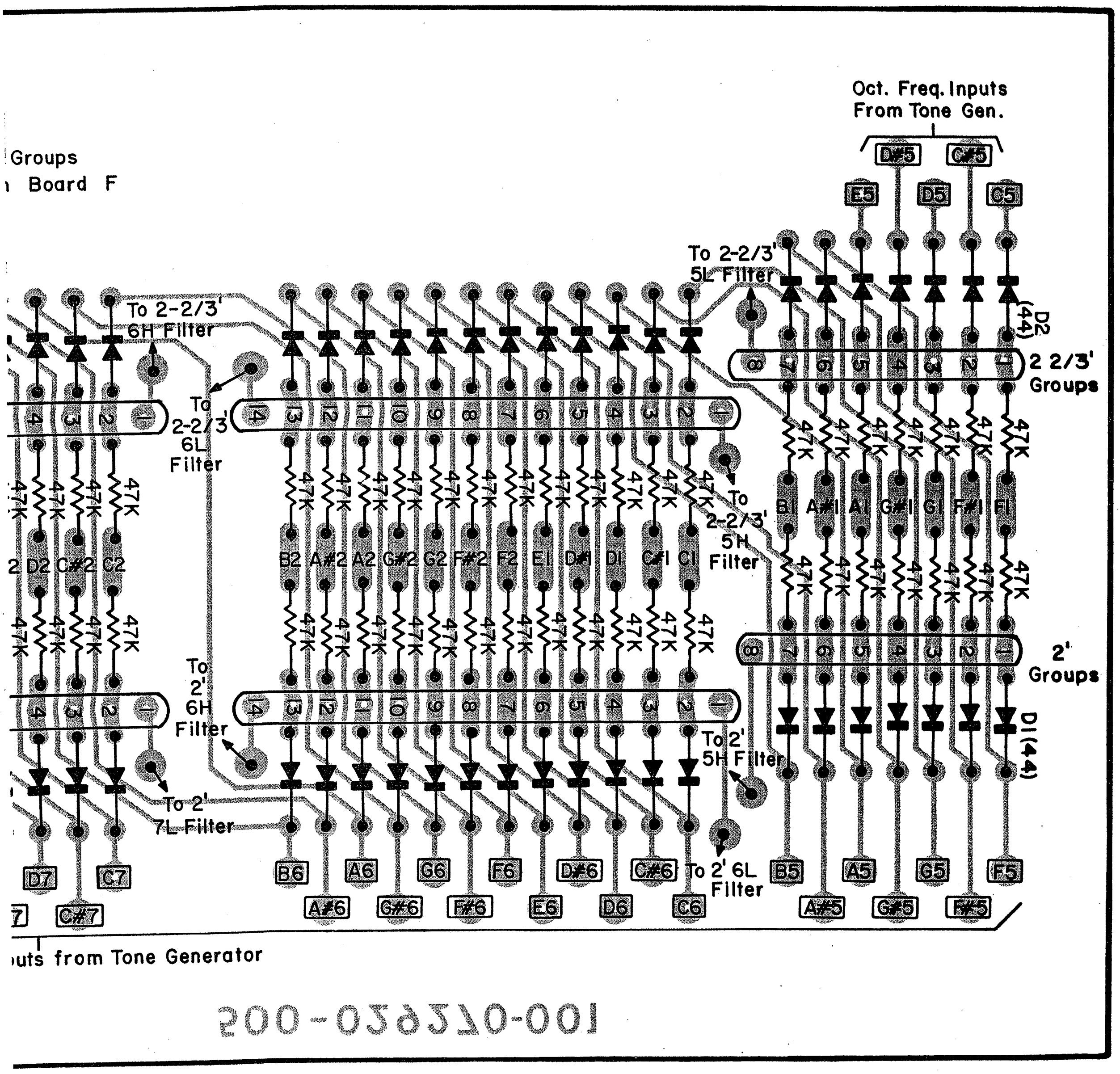
LOWER DIODE KEYING TOP


Norlin UM&LM DIODE KEYING
E4 F4 F#4 G4 G#4 A4 A#4 B4 C5 C#5 D5 D#5 E5 F5 F#5 G5 G#5 A5 A#5 B5 C6
E2 F3 F#3 G3 G#3 A3 A#3 B3 C3 C#3 D3 D#3 E3 F4 F#4 G4 G#4 A4 A#4 B4 C4
To 16' 4L Filter
To 16' 4H Filter
To 16' 5L Filter
To 16' 5H Filter
47K (12)
47K (7)
D1 (12)
D1 (7)
C#6 D6 D#6 E6 F6 F#6 G6 G#6 A6 A#6 B6 C7 C#7 D7 D#7 E7 F7 F#7 G7 G#7 A7 A#7
ng Groups to Flute
s on Board E
r Groups which
To Upper 8' 5L Filter
To Upper 8' 5H Filter
D2 (12)
D2 (7)
To Upper 8' 6L Filter
To Upper 8' 6H Filter
47K
F3
47K (12)
47K (7)
F#3 G3 G#3 A3 A#3 B3 C3 C#3 D3 D#3 E3 F4
F#4 G4 G#4 A4 A#4 B4 C4
.0022
.0015
.0047
.0033
To Upper 4' 6H Filter
To Upper 4' 7L Filter
To Upper 4' 7H Filter
D3 (42)
GND
C8 B7
E2 D#2 D2 C#2 C2 B2 A#2 A2 G#1 G1 F#1 F1
E1 D#1 D1 C#1 C1 B1 A#1 A1
To Lower 8' 4H Filter
To Lower 8' 3H Filter
47K (12)
68K
47K(8)
Inputs from Keyer Control Board D
Lower 8' Groups
D5 (12)
D5 (8)
To Lower 8' 4L Filter
To Lower 8' 3L Filter
F4 E4 D#4 D4 C#4 C4 B3 A#3 A3 G#3 G3 F#3 F3
E3 D#3 D3 C#3 C3 B2 A#2 A2
Octave Frequency Inputs From Tone Generator

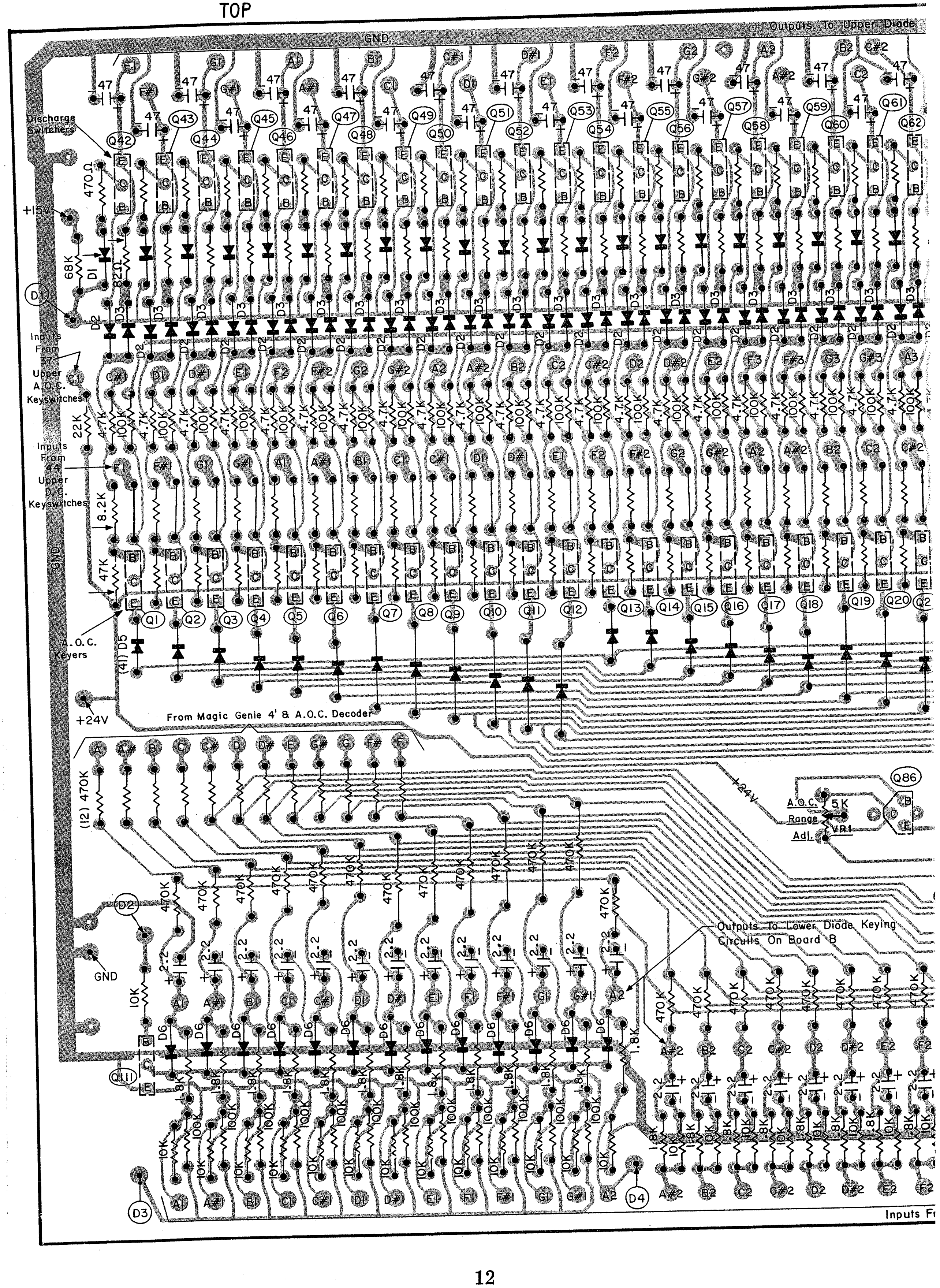
BOARD "C"


NOTE: All Diode Keyin
to Flute Filters
To 2-2/3' 8L Filter
D2 (44)
To 2-2/3' 7H Filter
To 2-2/3' 7L Filter
2-2/3' Groups
14
13
12
11
10
9
8
7
6
5
4
3
2
1
68K
47K
Inputs from Keyer Control Board D
C4
B4
A#4
A4
G#4
G4
F#4
F4
E3
D#3
D3
C#3
C3
B3
A#3
A3
G#3
G3
F#3
F3
E2
2' Groups
To 2' 7H Filter
To 2' 8H Filter
D1 (44)
To 2' 8L Filter
B8
A8
G8
F8
D#8
C#8
C9
A#8
G#8
F#8
E8
D8
C8
A#7
G#7
F#7
E7
B7
A7
G7
F7
Octave Frequency
DIODE KEYING
Norlin UM 2822/3

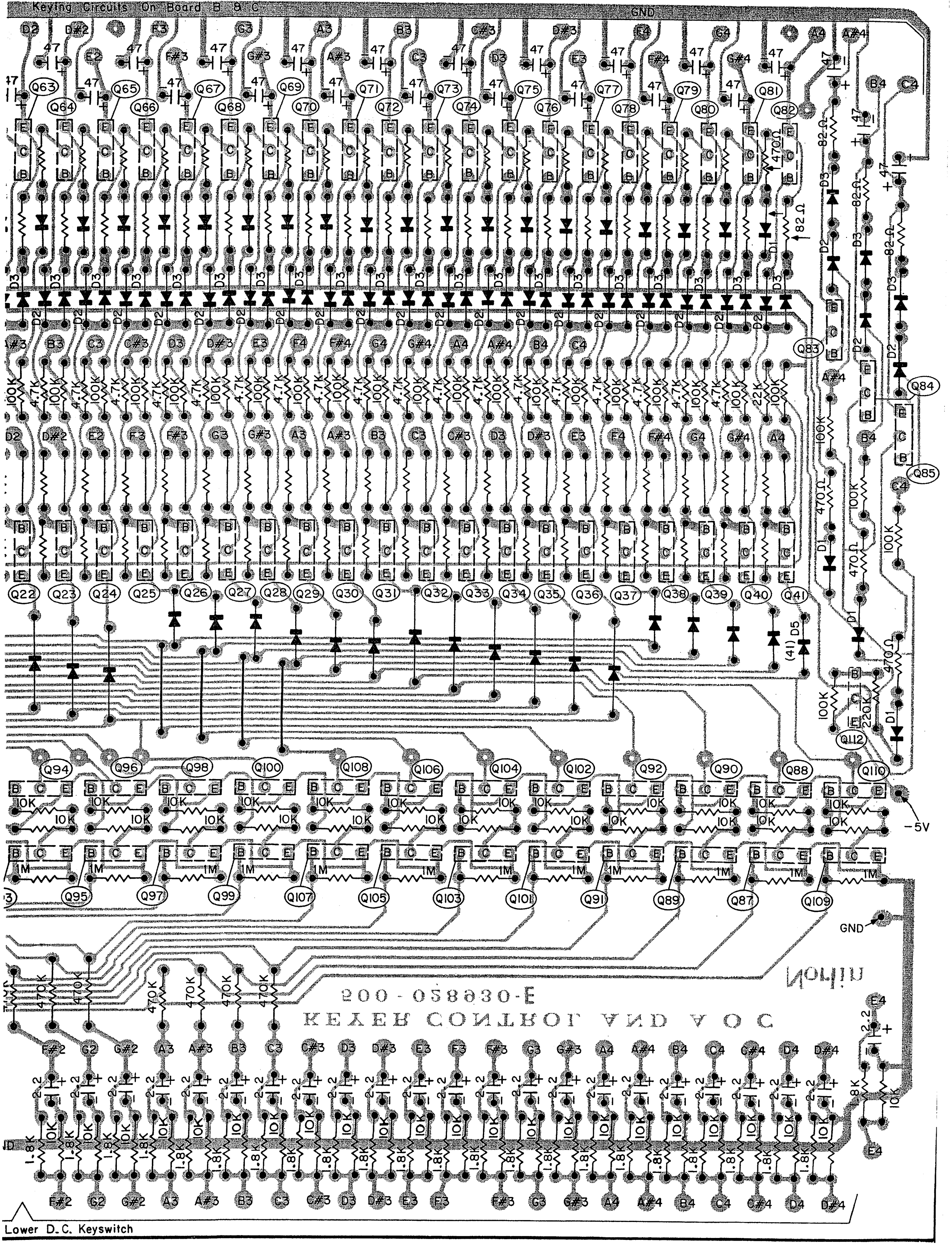
UPPER KEYBOARD 2' 8 2-2/3' DIODE KEYING


Oct. Freq. Inputs
From Tone Gen.
D#5
C#5
E5
D5
C5
Groups
Board F
To 2-2/3'
5L Filter
To 2-2/3'
6H Filter
D2 (44)
2 2/3'
Groups
To
2-2/3'
6L
Filter
14 13 12 11 10 9 8 7 6 5 4 3 2 1
47K
B1 A#1 A1 G#1 G1 F#1 F1
To
2-2/3'
5H
Filter
D2 C#2 C2
B2 A#2 A2 G#2 G2 F#2 F2 E1 D#1 D1 C#1 C1
2'
Groups
To
2'
6H
Filter
To 2'
5H Filter
D1(44)
To 2'
7L Filter
D7
C7
C#7
B6
A6
G6
F6
D#6
C#6
To 2' 6L
Filter
B5
A5
G5
F5
A#6
G#6
F#6
E6
D6
C6
A#5
G#5
F#5
uts from Tone Generator
100-02620-005

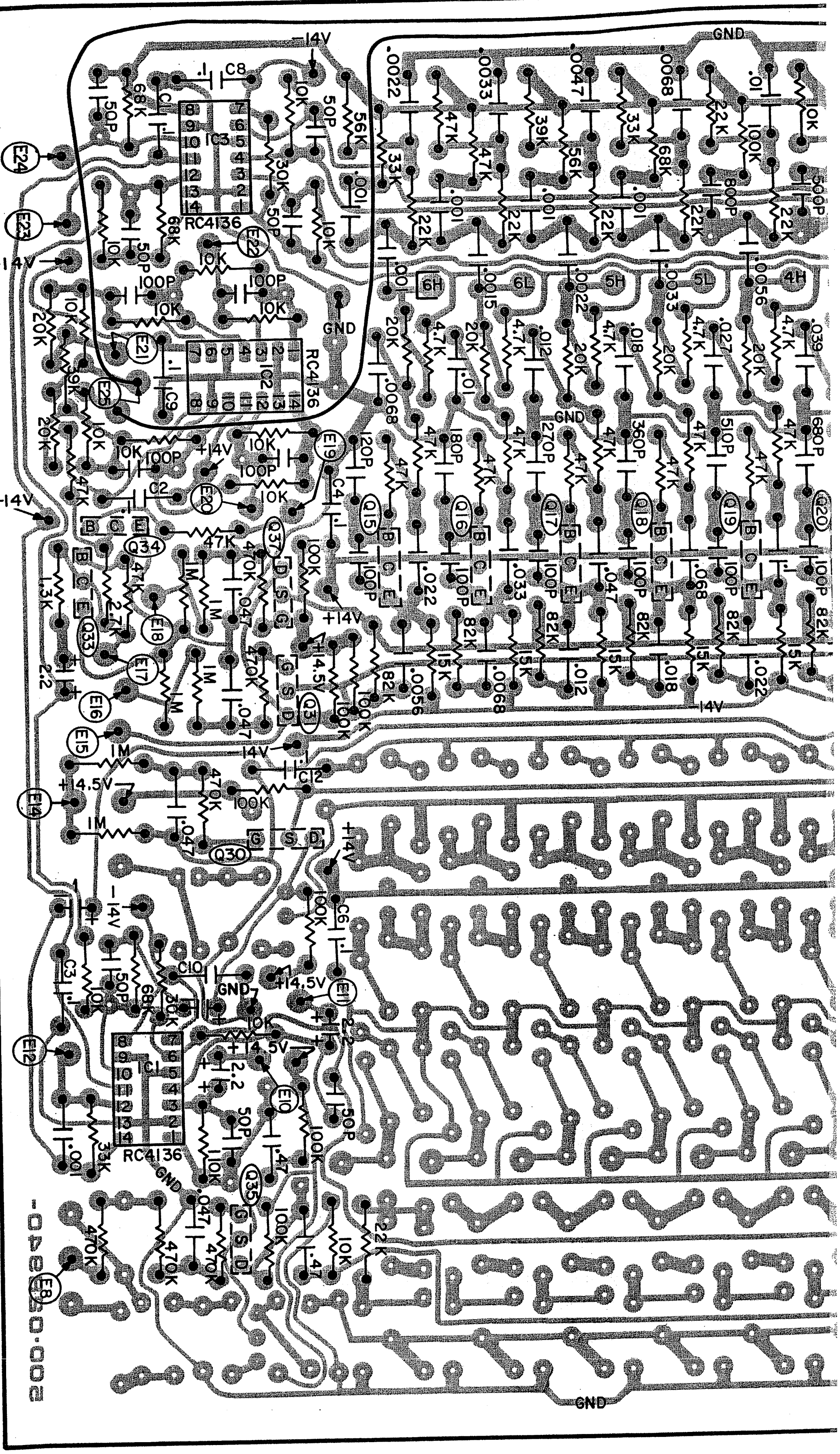
BOARD "D" KEYER


TOP
GND
Outputs To Upper Diode
Discharge Switchers
+15V
D1
Inputs From 37 Upper A.O.C. Keyswitches
Inputs From 44 Upper D.C. Keyswitches
A.O.C. Keyers
+24V
From Magic Genie 4' & A.O.C. Decoder
A.O.C. Range Adj.
5K
VR1
Q86
D2
GND
Outputs To Lower Diode Keying Circuits On Board B
Q11
D3
D4
Inputs F

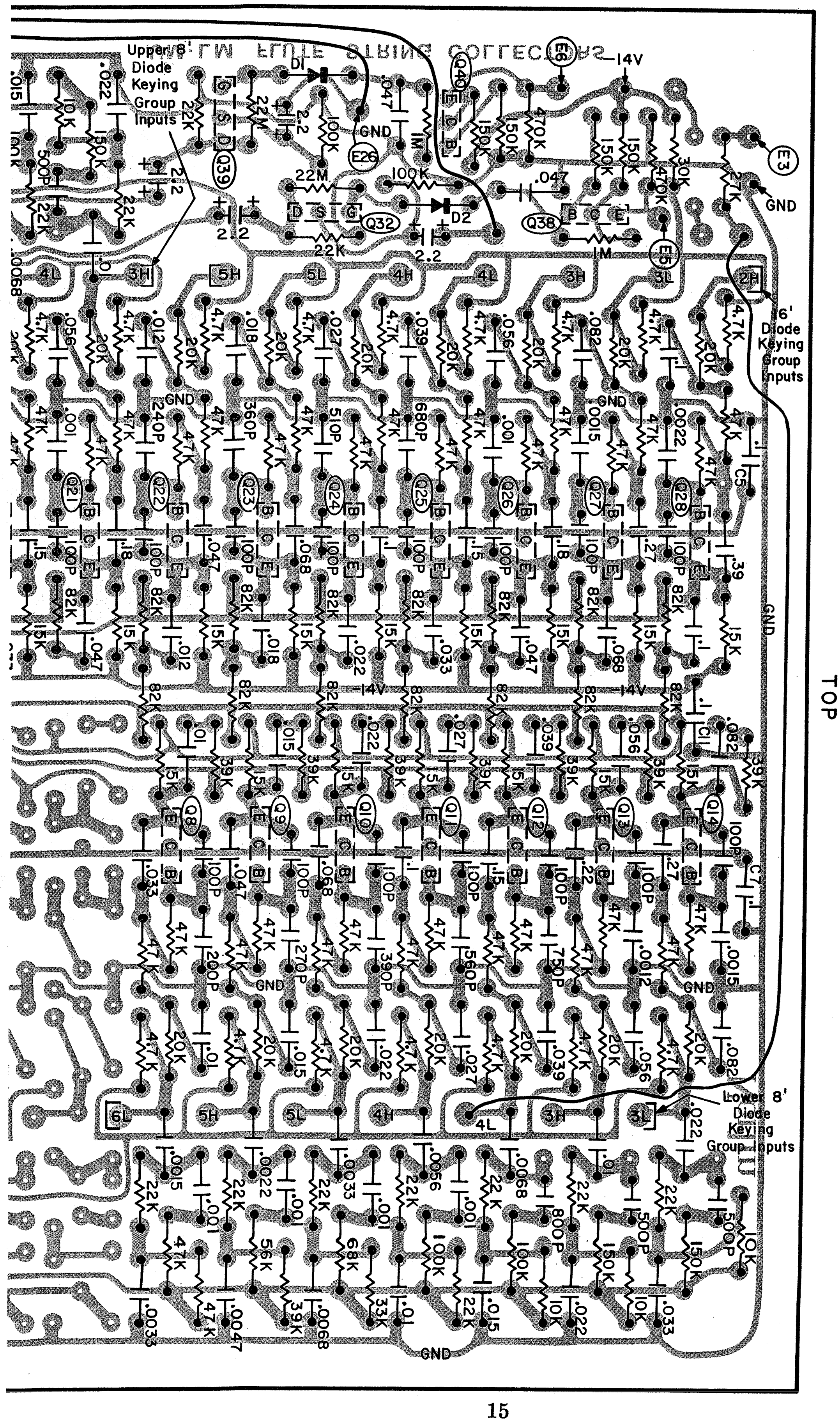
CONTROL & AOC


TOP
Keying Circuits On Board B & C
GND
-5V
GND
200-028930-E
KEYER CONTROL AND A O C
Norlin
Lower D.C. Keyswitch

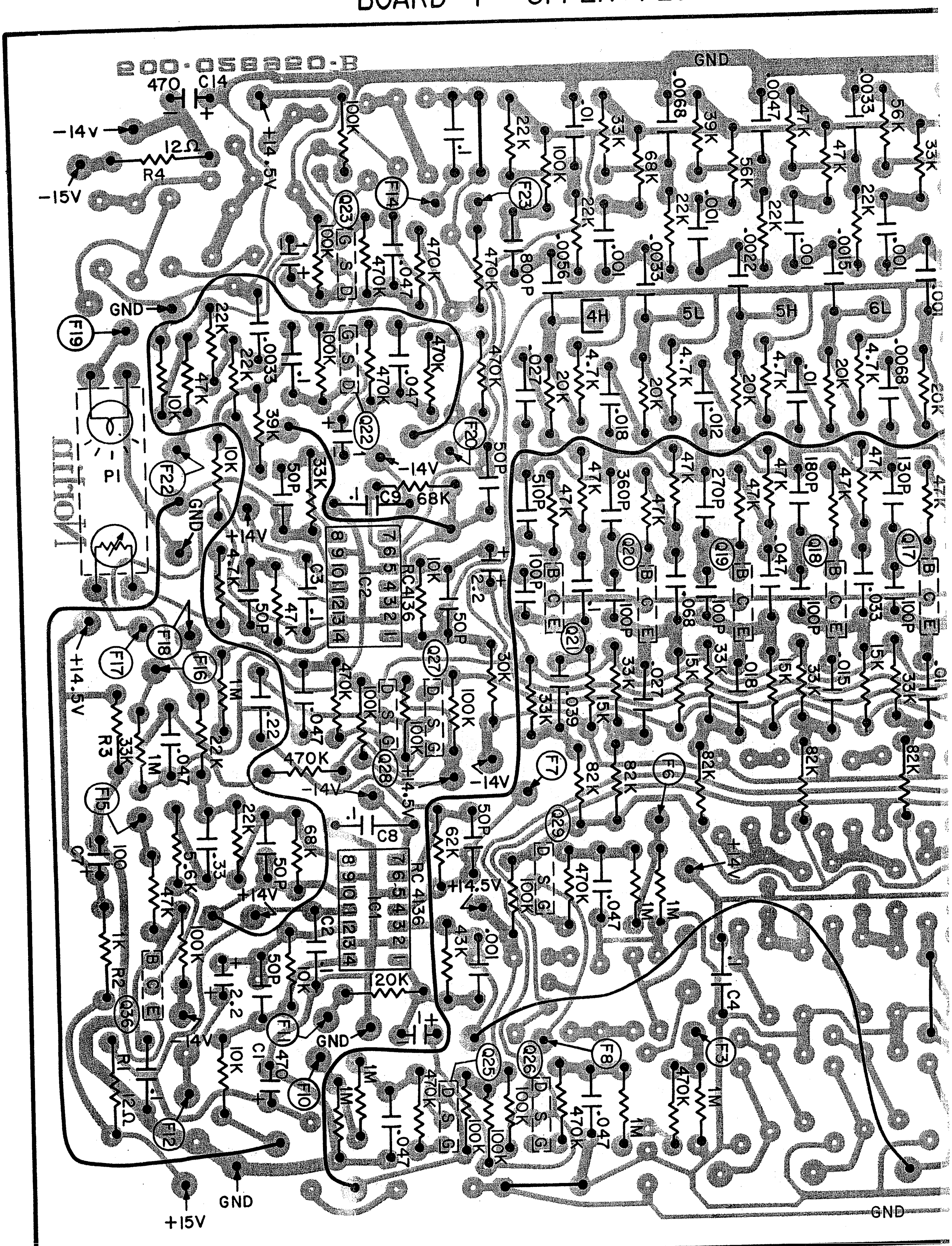
BOARD "E" UPPER/LOWER


GND
-14V
+14V
+14.5V
RC4136
IC1
IC2
IC3
C1
C2
C3
C4
C6
C8
C9
C10
C12
E8
E10
E11
E12
E14
E15
E16
E17
E18
E19
E20
E21
E22
E23
E24
E25
Q15
Q16
Q17
Q18
Q19
Q20
Q30
Q31
Q33
Q34
Q35
Q37
6H
6L
5H
5L
4H
B C E
G S D
.0022
.0033
.0047
.0068
.01
56K
33K
47K
4.7K
39K
68K
22K
100K
10K
800P
500P
30K
50P
100P
20K
.0015
.0022
.0033
.0056
.012
.018
.027
.039
.0068
120P
180P
270P
360P
510P
680P
.022
.033
.047
.068
82K
15K
.056
1M
470K
2.7K
1.3K
2.2
.47

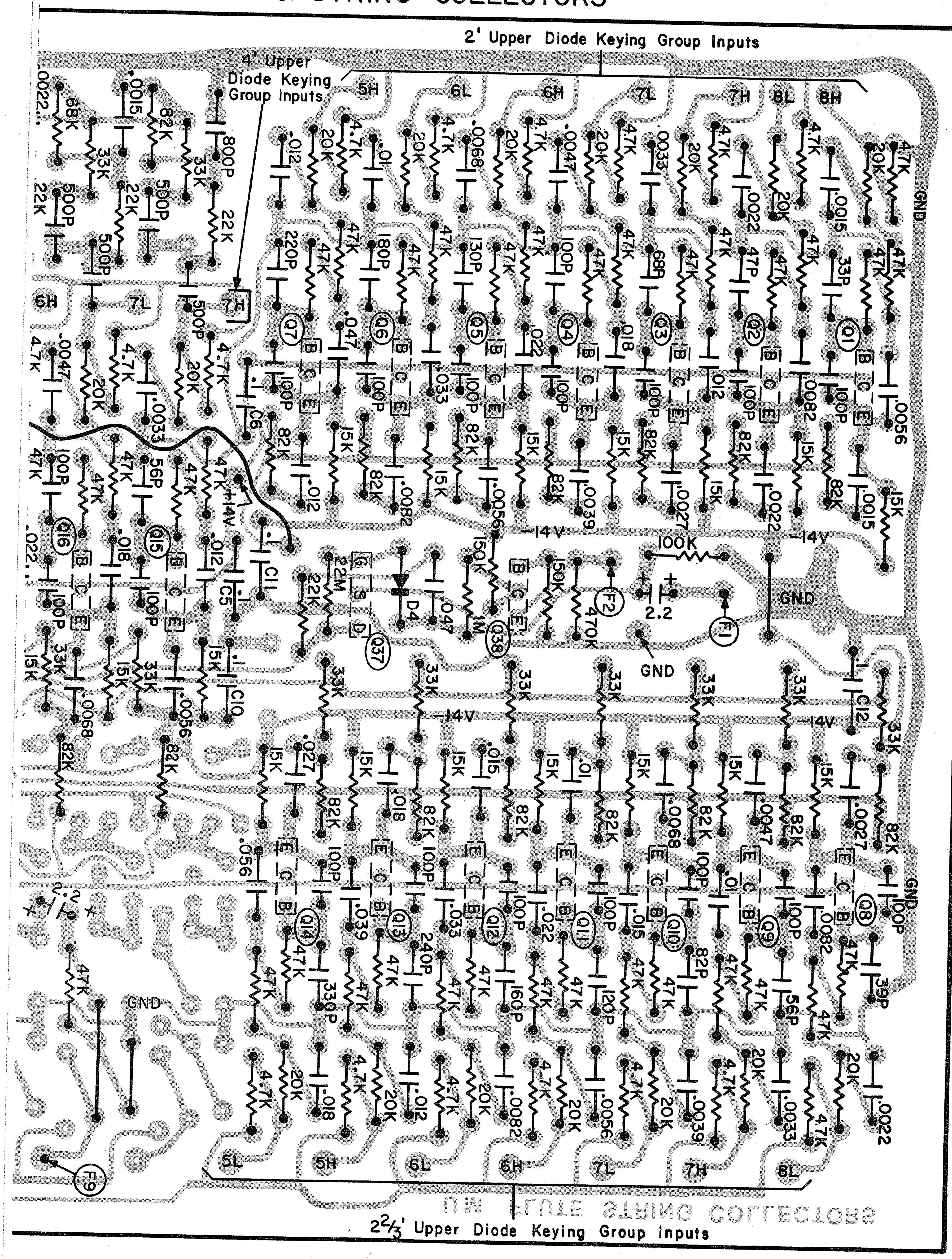
FLUTE & STRING COLLECTORS


Upper 8' Diode Keying Group Inputs
16' Diode Keying Group Inputs
Lower 8' Diode Keying Group Inputs
TOP
GND
14V
-14V
E3
E5
E6
E26
D1
D2
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q21
Q22
Q23
Q24
Q25
Q26
Q27
Q28
Q32
Q38
Q39
Q40
C1
C5
C7
6L
5H
5L
4H
4L
3H
3L
2H

BOARD "F" UPPER FLUTE


200-058220-B
470
C14
-14V
12Ω
R4
-15V
+14.5V
100K
Q23
F14
F23
22K
.01
33K
.0068
39K
.0047
47K
.0033
56K
68K
56K
47K
GND
F19
P1
F22
Q22
-14V
C9
68K
F20
50P
4H
5L
5H
6L
4.7K
20K
.027
.018
.012
.01
.0068
510P
360P
270P
180P
130P
Q20
Q19
Q18
Q17
Q21
IC2
RC4136
+14V
4.7K
C3
F18
F17
F16
+14.5V
R3
1M
.047
.22
470K
Q27
Q28
100K
30K
-14V
F7
F6
F15
Q29
C8
IC1
RC 4136
62K
+14.5V
C7
100
5.6K
.33
+14V
C2
43K
.001
C4
F3
1K
R2
Q36
2.2
20K
-14V
C1
470
GND
F11
F10
F8
Q25
Q26
R1
12Ω
F12
GND
+15V
GND
82K
15K
33K
.039
.068
.018
.015

8 STRING COLLECTORS

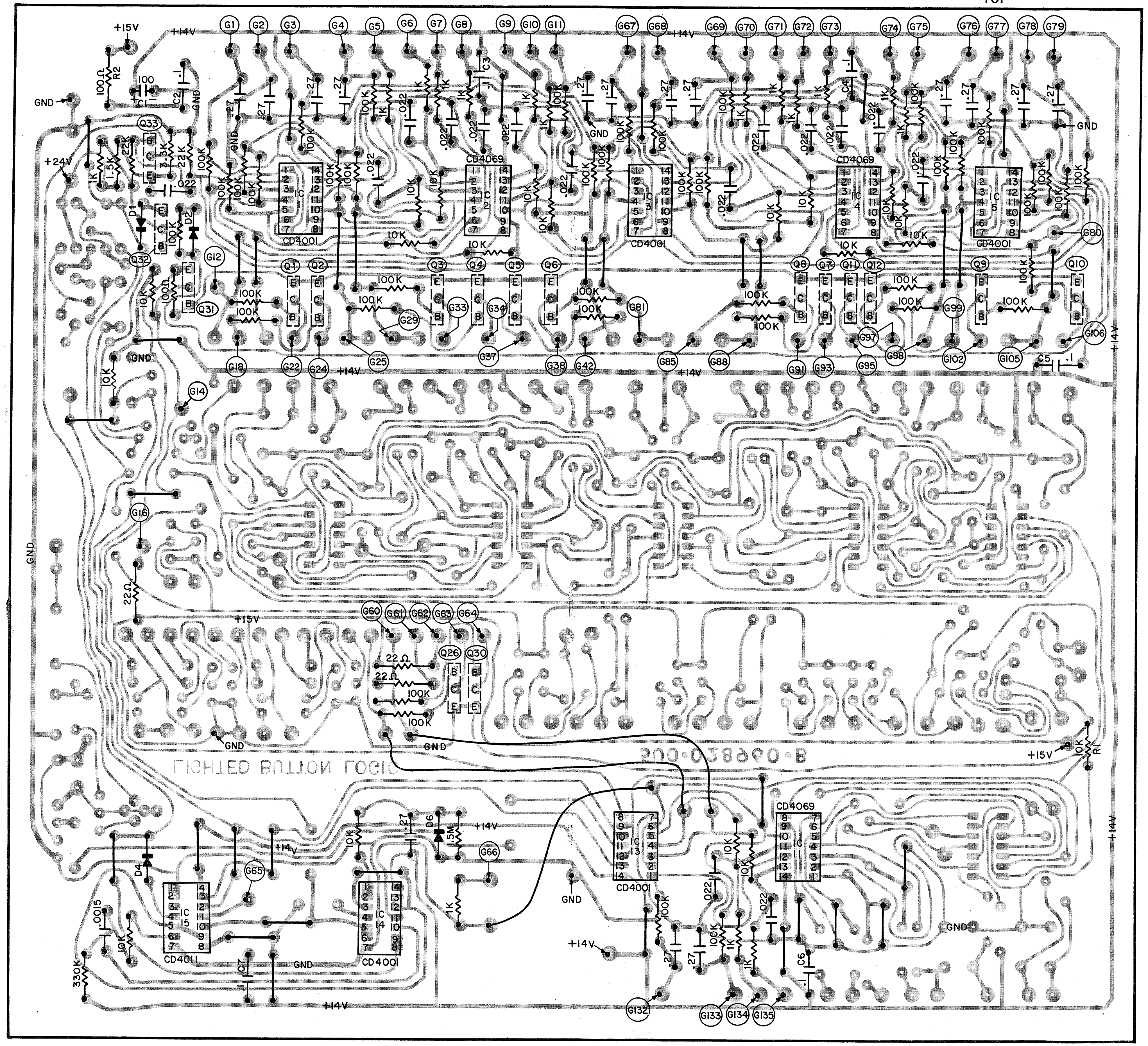

2' Upper Diode Keying Group Inputs
4' Upper Diode Keying Group Inputs
5H
6L
6H
7L
7H
8L
8H
6H
7L
7H
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q37
Q38
B
C
E
G
S
D
D4
C1
C5
C6
C10
C12
F1
F2
F9
+14V
−14V
100K
150K
1M
22M
22K
150K
470K
2.2
GND
UM FLUTE STRING COLLECTORS
5L
5H
6L
6H
7L
7H
8L
2 2/3' Upper Diode Keying Group Inputs

TOP

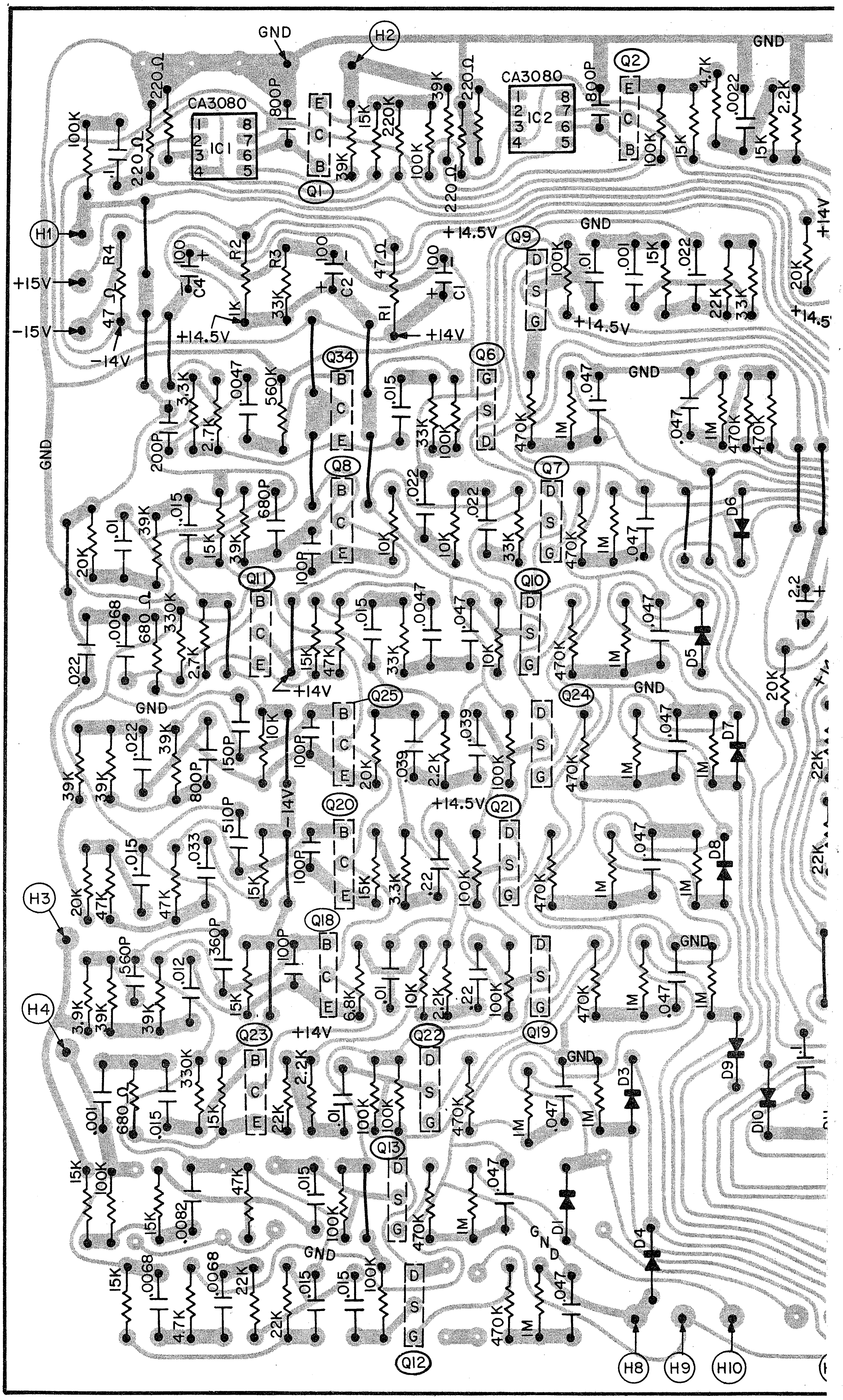
BOARD "G"

LIGHTED BUTTON LOGIC

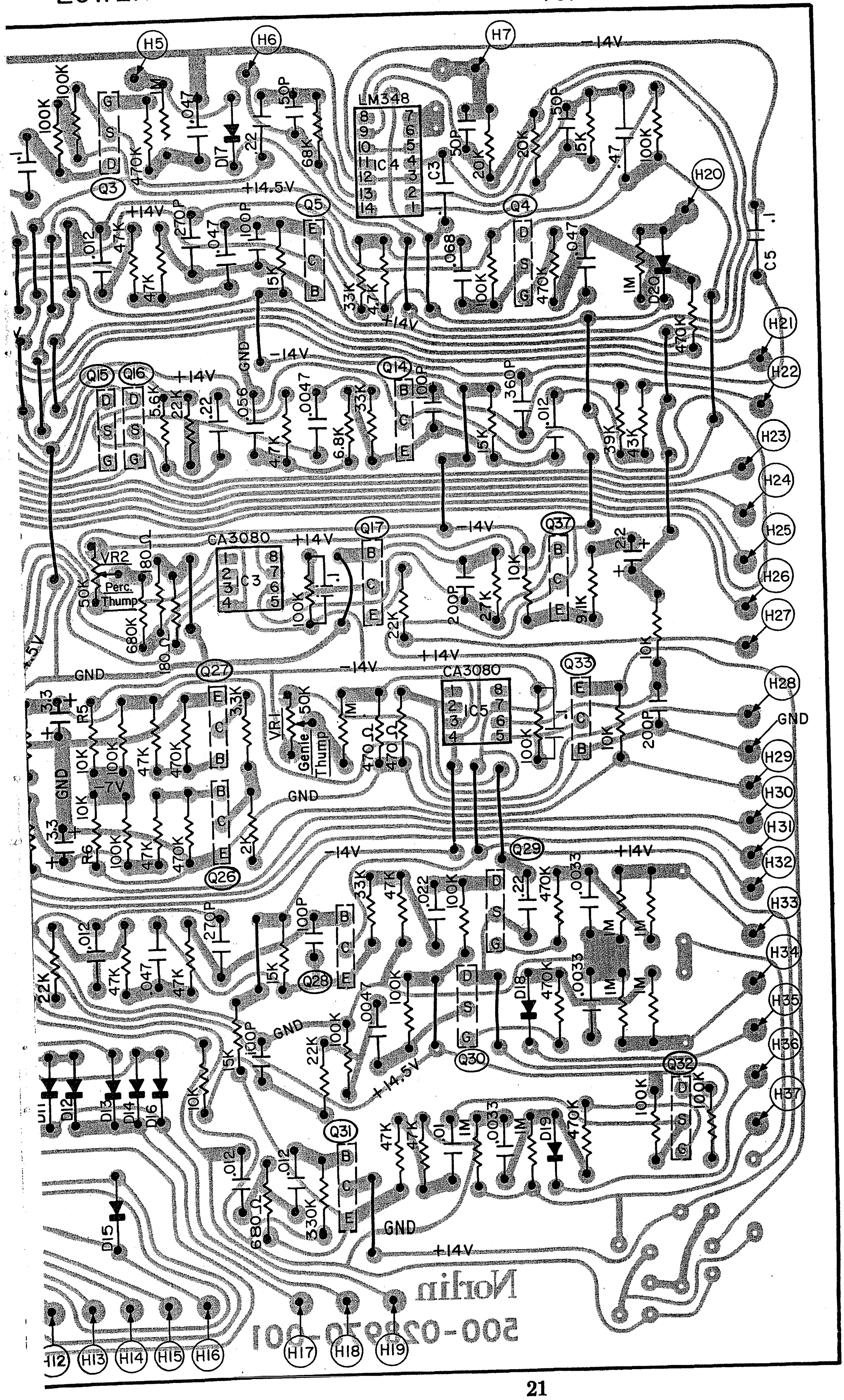
TOP


+15V
+14V
+24V
GND
R1
R2
C1
C2
C3
C4
C5
C6
C7
D1
D2
D4
D6
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q26
Q30
Q31
Q32
Q33
IC 1
IC 2
IC 3
IC 4
IC 5
IC 11
IC 13
IC 14
IC 15
CD4001
CD4069
CD4011
100Ω
100K
10K
1K
1.5K
22K
3.3K
22Ω
1.5M
330K
.27
.022
.1
.0015
100
G1
G2
G3
G4
G5
G6
G7
G8
G9
G10
G11
G12
G14
G16
G18
G22
G24
G25
G29
G33
G34
G37
G38
G42
G60
G61
G62
G63
G64
G65
G66
G67
G68
G69
G70
G71
G72
G73
G74
G75
G76
G77
G78
G79
G80
G81
G85
G88
G91
G93
G95
G97
G98
G99
G102
G105
G106
G132
G133
G134
G135
LIGHTED BUTTON LOGIC
500-028660-B

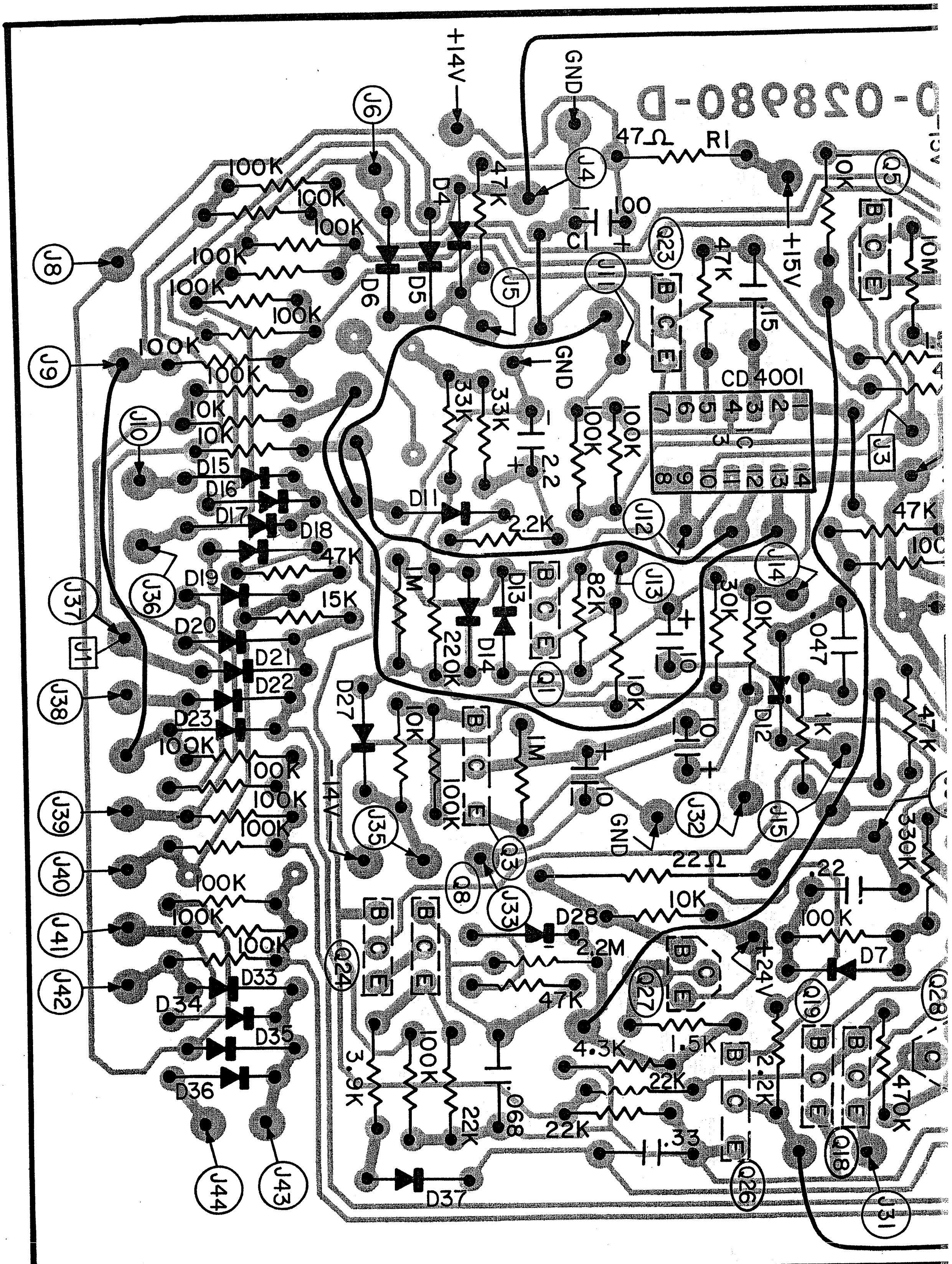
TOP BOARD "H" UPPER/


GND
H2
GND
CA3080
IC1
CA3080
IC2
220 Ω
100K
800P
Q1
E
C
B
15K
39K
220K
100K
39K
220 Ω
800P
Q2
4.7K
.0022
15K
2.2K
10K
H1
+15V
-15V
R4
47 Ω
-14V
C4
100
R2
1K
R3
33K
C2
100
47 Ω
R1
C1
100
+14.5V
+14V
+14.5V
Q9
D
S
G
100K
.01
.001
15K
.022
22K
33K
20K
+14V
+14.5V
Q34
Q6
GND
3.3K
.0047
560K
.015
33K
100K
470K
1M
.047
.047
1M
470K
470K
200P
2.7K
GND
Q8
Q7
.015
.01
39K
20K
15K
39K
680P
100P
10K
.022
10K
.022
33K
470K
1M
.047
D6
Q11
Q10
.022
.0068
680 Ω
330K
2.7K
15K
47K
.015
33K
.0047
.047
10K
470K
1M
.047
D5
2.2
+14V
20K
Q25
Q24
GND
GND
39K
39K
.022
39K
800P
150P
10K
100P
20K
.039
2.2K
.039
100K
470K
1M
.047
1M
D7
22K
-14V
Q20
+14.5V
Q21
H3
20K
47K
.015
47K
.033
510P
15K
100P
15K
3.3K
.22
100K
470K
1M
.047
1M
D8
22K
Q18
H4
3.9K
39K
560P
39K
.012
360P
15K
100P
6.8K
.01
10K
2.2K
.22
100K
470K
1M
.047
1M
GND
Q23
+14V
Q22
Q19
.001
680 Ω
.015
330K
15K
22K
2.2K
.01
100K
100K
470K
1M
.047
1M
GND
D3
D9
D10
Q13
15K
100K
15K
.0082
47K
.015
100K
100K
470K
1M
.047
GND
D1
D4
15K
.0068
4.7K
.0068
22K
22K
.015
GND
.015
100K
470K
1M
.047
Q12
H8
H9
H10

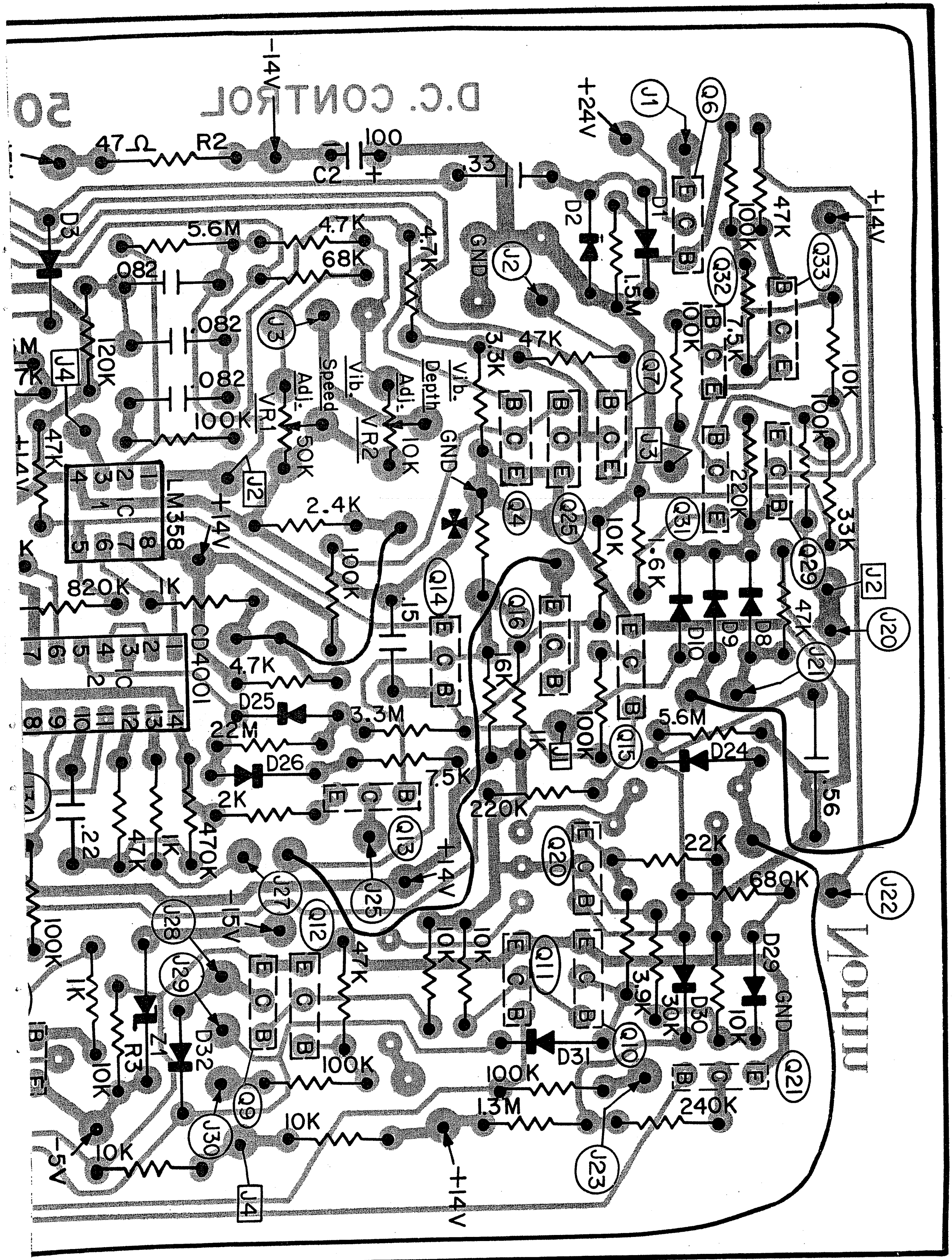
LOWER REED/STRING Q.C. TOP


H5
H6
H7
-14V
100K
100K
G
S
D
1M
.047
D17
.22
50P
68K
LM348
IC4
C3
50P
20K
20K
50P
15K
.47
100K
Q3
+14.5V
+14V
.012
47K
47K
47K
270P
.047
100P
15K
Q5
E
C
B
33K
4.7K
+14V
.068
100K
Q4
D
S
G
470K
.047
1M
D20
470K
H20
.1
C5
H21
H22
GND
-14V
Q15
Q16
+14V
5.6K
22K
.22
.056
.0047
4.7K
6.8K
33K
Q14
100P
360P
15K
.012
39K
43K
H23
H24
H25
H26
H27
CA3080
+14V
Q17
VR2
Perc. Thump
50K
180Ω
680K
180Ω
IC3
.1
100K
22K
-14V
Q37
200P
2.7K
10K
9.1K
2.2
+14V
CA3080
IC5
Q33
10K
200P
H28
GND
GND
Q27
-14V
3.3
R5
10K
10K
100K
47K
470K
3.3K
VR1
50K
Genie Thump
1M
470Ω
470Ω
100K
10K
H29
H30
H31
H32
GND
-7V
10K
3.3
R6
100K
47K
470K
2K
Q26
-14V
Q29
+14V
33K
47K
.022
100K
.22
470K
.0033
1M
1M
H33
.012
22K
47K
.047
47K
270P
15K
15K
100P
Q28
.0047
100K
D18
470K
.0033
1M
1M
H34
H35
H36
GND
130P
22K
100K
Q30
+14.5V
D11
D12
D13
D14
D16
15K
10K
Q32
100K
100K
H37
Q31
47K
47K
.01
1M
.0033
1M
D19
470K
.012
.012
680Ω
330K
GND
+14V
D15
H12
H13
H14
H15
H16
H17
H18
H19

BOARD "J"


+14V
GND
-028980-D
J6
J8
J9
J10
100K
100K
100K
100K
100K
100K
100K
100K
D4
D5
D6
47K
J4
47Ω
R1
100
C1
+
Q23
J11
J5
+15V
47K
15
Q5
10K
10M
B
C
E
CD4001
GND
33K
33K
2.2
100K
100K
D11
2.2K
J12
J3
47K
100
10K
10K
D15
D16
D17
D18
J36
47K
D19
15K
J37
J1
D20
D21
D22
J38
D23
1M
220K
D13
D14
Q1
82K
J13
10
10K
30K
10K
J14
.047
D12
1K
47K
D27
10K
100K
1M
10
GND
J32
J15
330K
-14V
J35
Q3
Q8
J33
22Ω
.22
10K
D28
100K
D7
2.2M
47K
+24V
Q27
Q19
Q28
Q24
J39
J40
J41
J42
D33
D34
D35
D36
J43
J44
3.9K
100K
22K
.068
22K
4.3K
1.5K
22K
2.2K
.33
Q26
Q18
470K
J31
D37

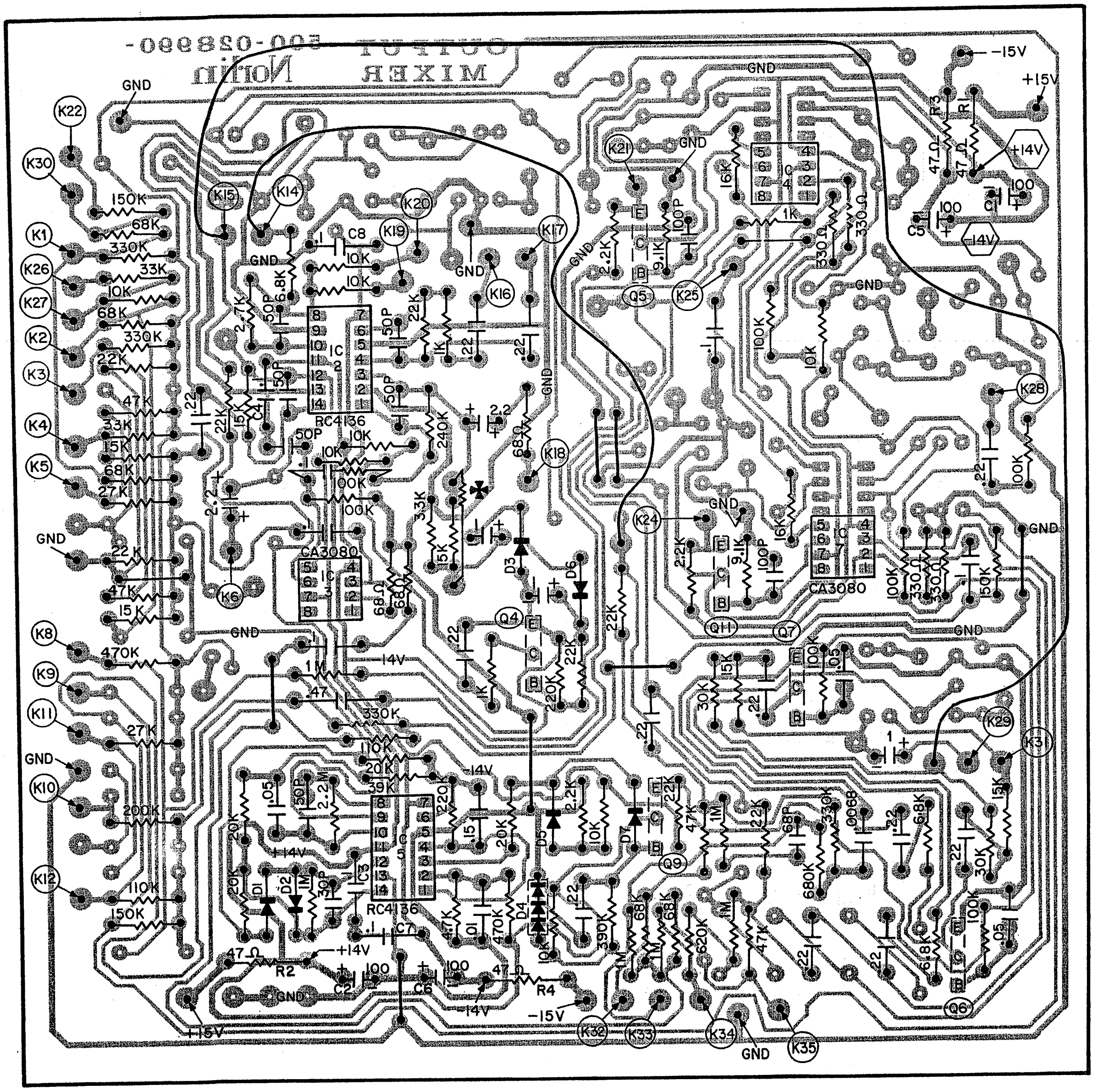
D.C. CONTROL


-14V
+24V
+14V
-15V
-5V
47Ω
R2
100
C2
.33
GND
J1
J2
J3
J4
J20
J21
J22
J23
J25
J27
J28
J29
J30
D1
D2
D3
D8
D9
D10
D24
D25
D26
D29
D30
D31
D32
Z1
R3
Q4
Q6
Q7
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q20
Q21
Q25
Q29
Q31
Q32
Q33
LM358
IC
CD4001
IC2
VR1
VR2
Vib. Speed Adj.
Vib. Depth Adj.
50K
10K
5.6M
4.7K
68K
.082
120K
100K
47K
820K
1K
2.4K
.15
3.3M
22M
7.5K
2K
.22
470K
220K
22K
680K
3.9K
30K
240K
1.3M
1.5M
1.6K
33K
3.3K
16K
.56

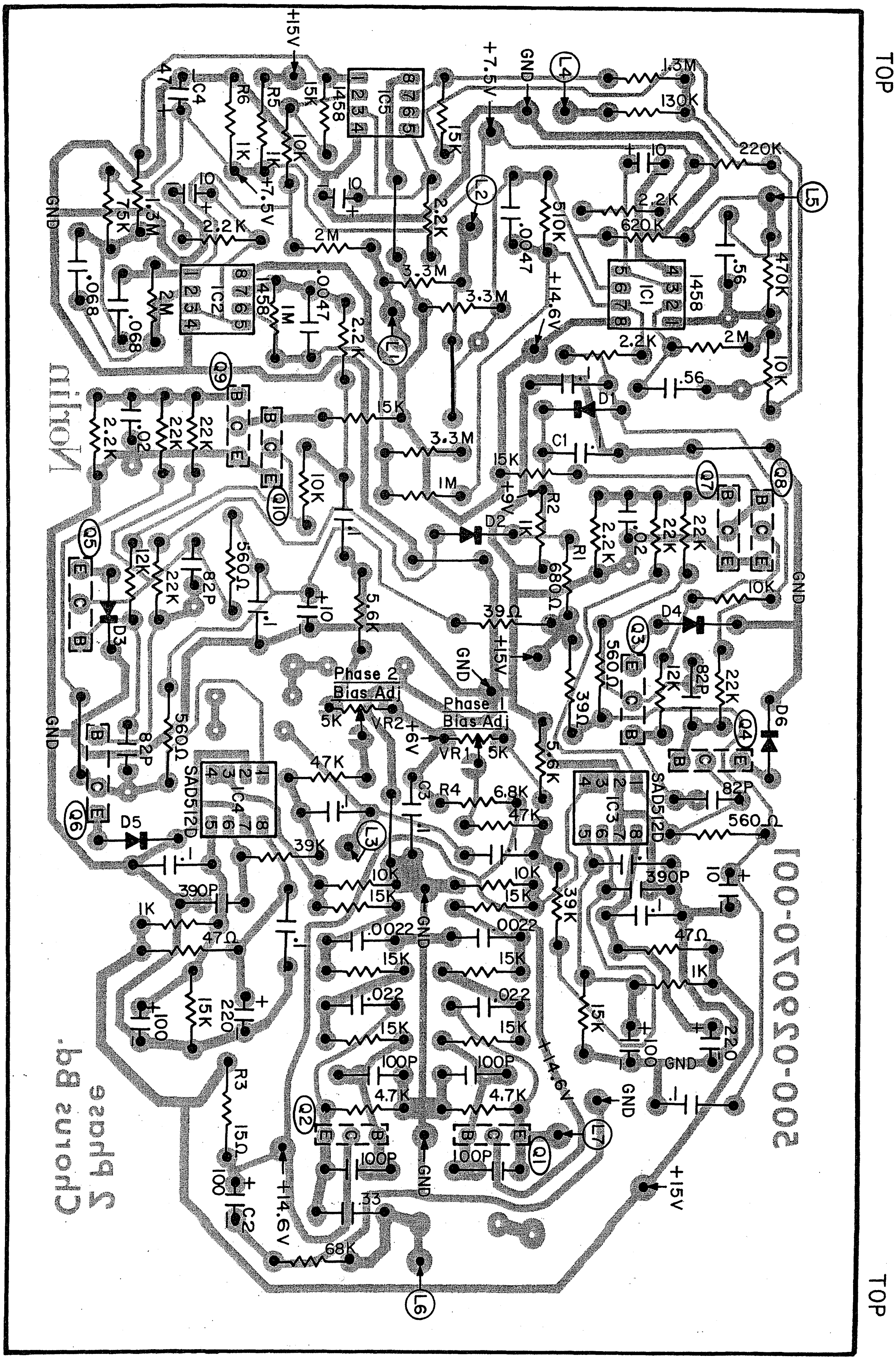
Boxed $\boxed{J}$ Nos. Indicate On-Board Jumpers

BOARD "K" OUTPUT MIXER

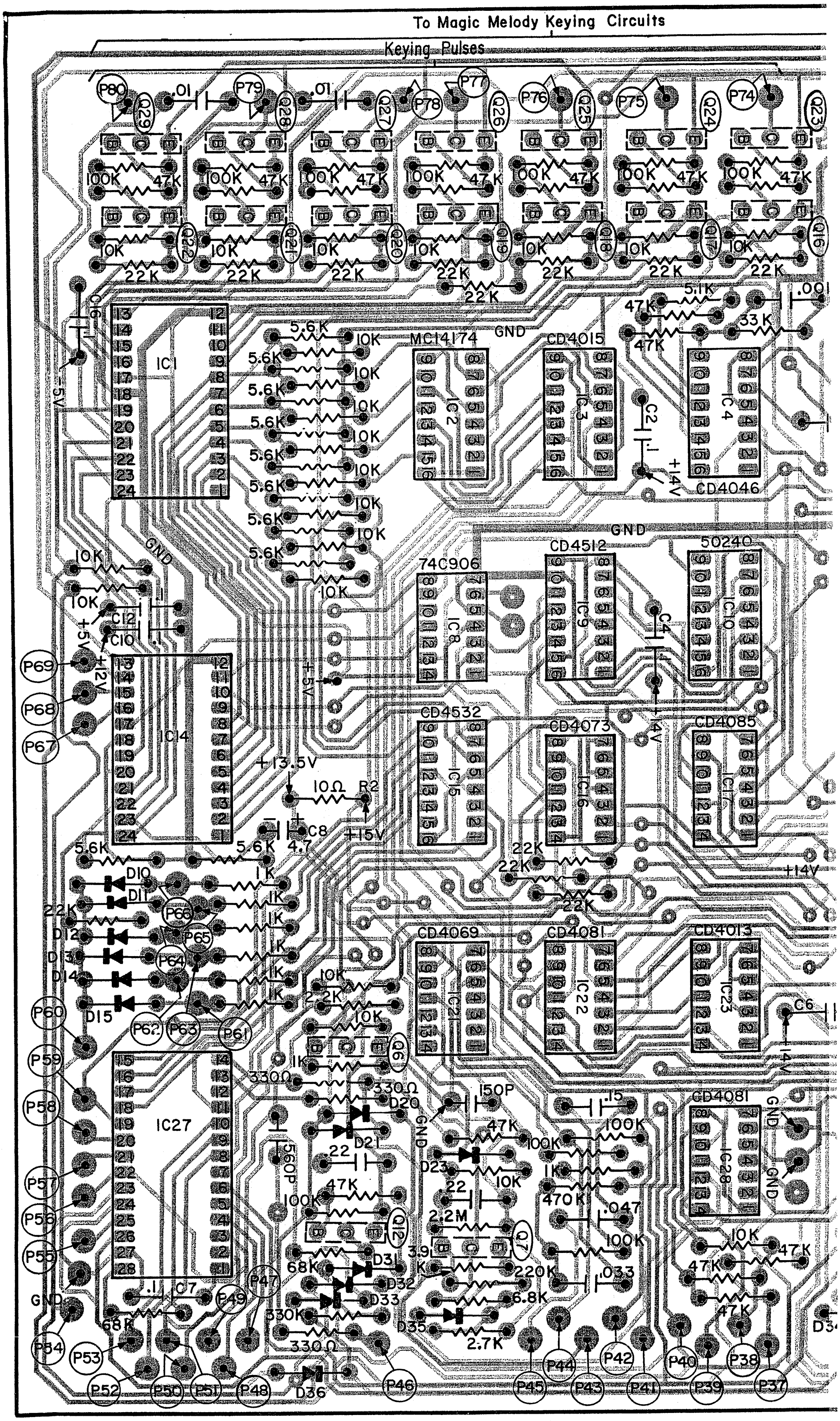
TOP


500-028990-
OUTPUT
MIXER
Norlin
GND
-15V
+15V
+14V
-14V
K1
K2
K3
K4
K5
K6
K8
K9
K10
K11
K12
K14
K15
K16
K17
K18
K19
K20
K21
K22
K24
K25
K26
K27
K28
K29
K30
K31
K32
K33
K34
K35
RC4136
CA3080
Q1
Q4
Q5
Q6
Q7
Q9
D1
D2
D3
D4
D5
D6
D7
C1
C2
C3
C4
C5
C6
C7
C8
R1
R2
R3
R4
IC
150K
68K
330K
33K
10K
22K
47K
15K
27K
470K
200K
110K
100K
240K
220K
390K
620K
680K
2.2K
6.8K
9.1K
16K
1K
1M
2.2M
47Ω
330Ω
50P
100P
68P
30P
.0068
.05
.47
.22
2.2
100
.1

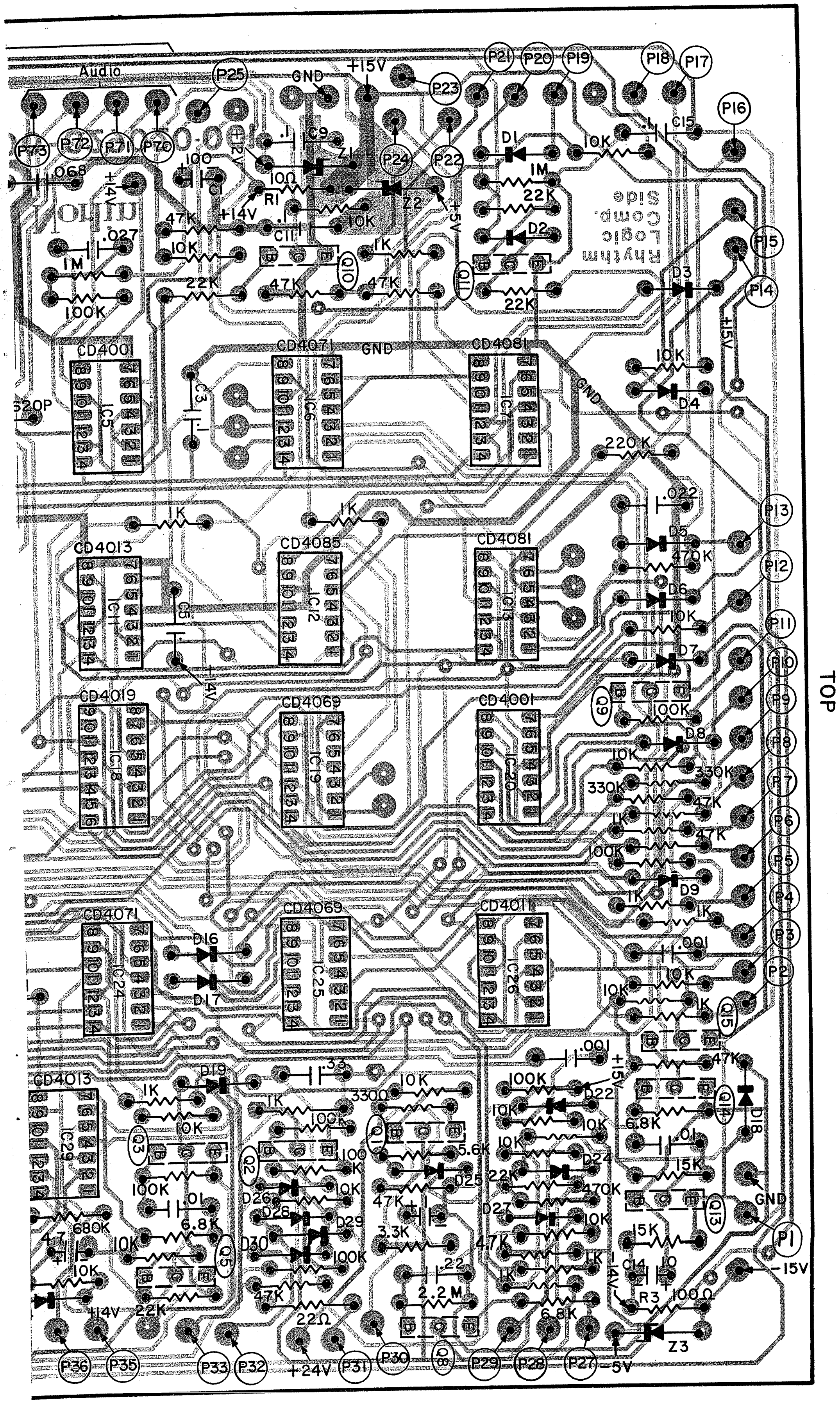
BOARD "L" CHORUS


TOP
TOP
+15V
+7.5V
GND
L1
L2
L3
L4
L5
L6
L7
IC1
IC2
IC3
IC4
IC5
1458
SAD512D
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
D1
D2
D3
D4
D5
D6
C1
C2
C3
C4
R1
R2
R3
R4
R5
R6
VR1
VR2
Phase 1 Bias Adj
Phase 2 Bias Adj
5K
+6V
+9V
+14.6V
1.3M
130K
220K
2.2K
620K
510K
470K
.56
.0047
.047
.068
3.3M
2M
1M
15K
10K
22K
12K
560Ω
82P
680Ω
39Ω
5.6K
6.8K
47K
39K
390P
47Ω
1K
100
220
.0022
.022
100P
4.7K
15Ω
68K
.33
.02
10
47
2 Phase Chorus Bd.
500-0290-005

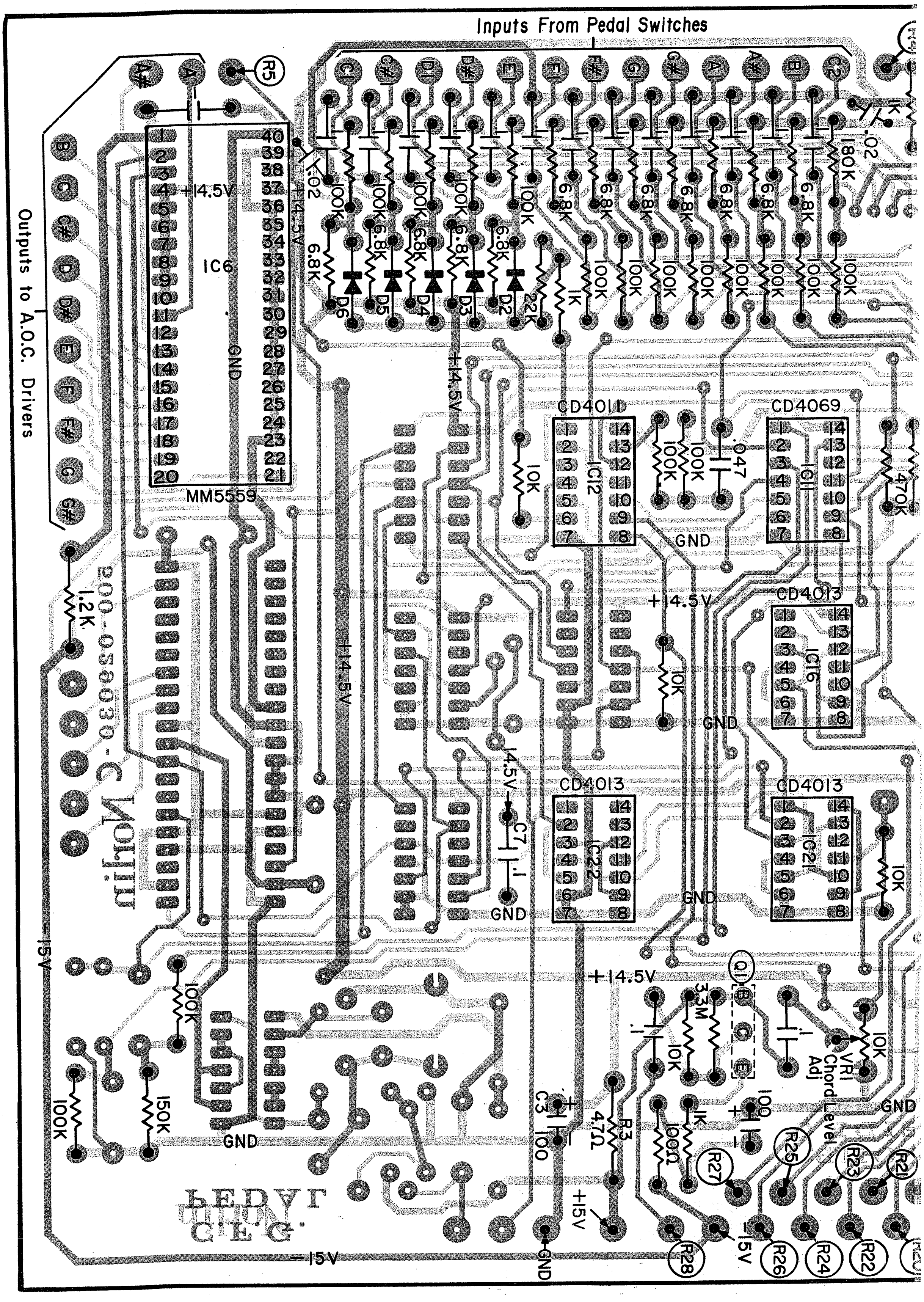
BOARD "P"


To Magic Melody Keying Circuits
Keying Pulses
P80
P79
P78
P77
P76
P75
P74
.01
.01
Q29
Q28
Q27
Q26
Q25
Q24
Q23
Q22
Q21
Q20
Q19
Q18
Q17
Q16
B C E
100K
47K
10K
22K
5.1K
33K
.001
C16
-5V
IC1
5.6K
MC14174
GND
CD4015
IC2
IC3
IC4
C2
.1
+14V
CD4046
CD4512
50240
74C906
IC8
IC9
IC10
C4
+5V
CD4532
CD4073
CD4085
IC15
IC16
IC17
IC14
C12
C10
+12V
P69
P68
P67
+13.5V
10Ω
R2
C8
4.7
+15V
1K
22K
D10
D11
D12
D13
D14
D15
P66
P65
P64
P63
P62
P61
P60
P59
P58
P57
P56
P55
P54
P53
P52
P51
P50
P49
P48
P47
P46
P45
P44
P43
P42
P41
P40
P39
P38
P37
CD4069
CD4081
CD4013
IC21
IC22
IC23
C6
Q6
Q7
Q12
330Ω
D20
D21
D23
D31
D32
D33
D35
D36
150P
.15
560P
22
2.2M
3.9K
220K
6.8K
2.7K
470K
.047
.033
68K
330K
IC27
IC28
C7
GND

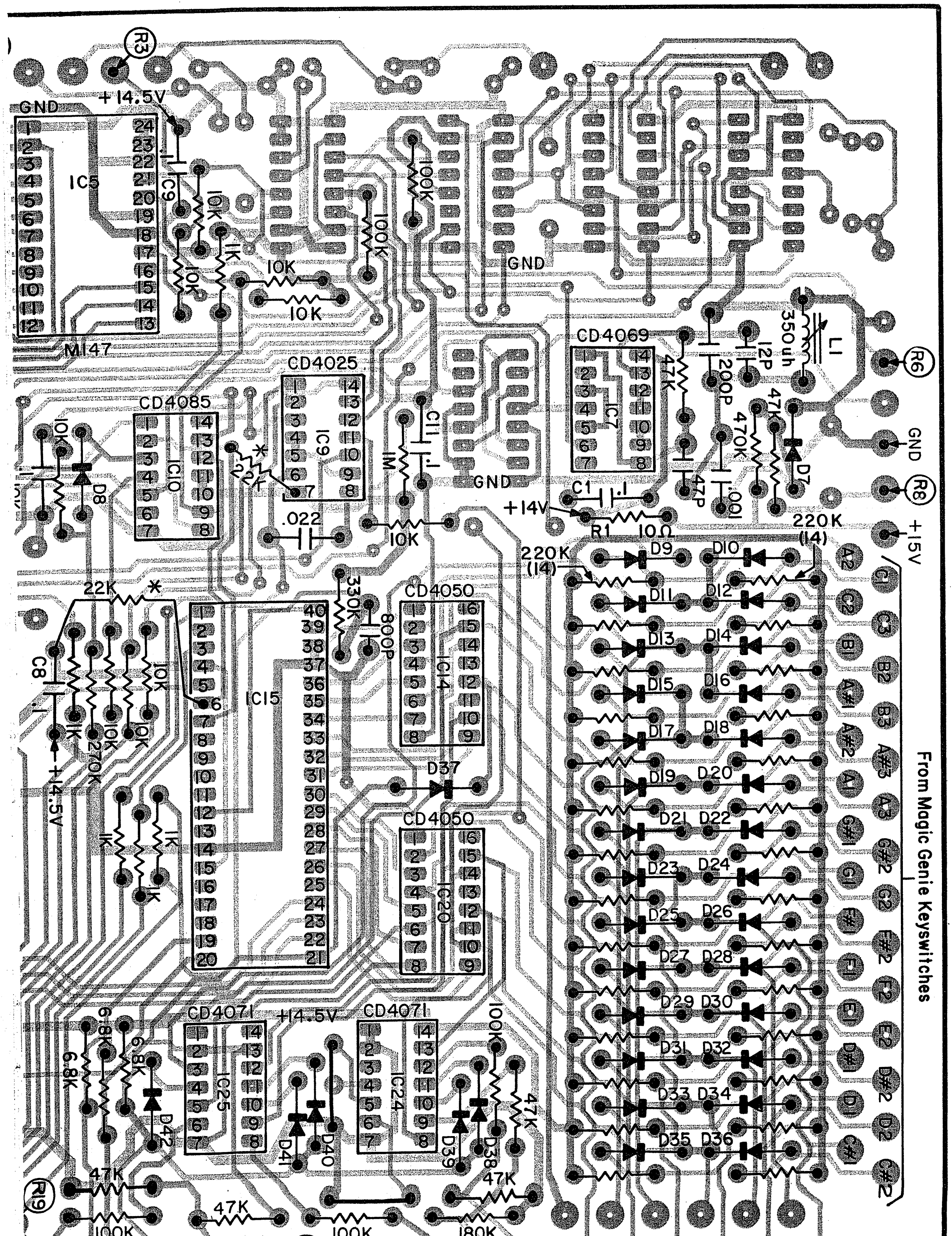
RHYTHM LOGIC


Audio
P73
P72
P71
P70
P25
GND
+15V
P23
P21
P20
P19
P18
P17
P16
C15
.1
10K
D1
1M
22K
D2
Rhythm
Logic
Comp.
Side
Q11
22K
P24
P22
+5V
Z2
Z1
C9
.1
+12V
100
C1
10Ω
R1
+14V
.068
+14V
47K
10K
C11
.1
1K
Q10
47K
47K
22K
.027
1M
100K
P15
P14
D3
+15V
10K
D4
CD4001
IC5
620P
CD4071
IC6
C3
.1
GND
CD4081
IC7
GND
220K
.022
D5
470K
P13
D6
10K
P12
D7
P11
CD4013
IC11
1K
C5
+14V
CD4085
IC12
1K
CD4081
IC13
Q9
100K
P10
D8
P9
10K
330K
P8
330K
47K
P7
1K
47K
P6
100K
P5
D9
1K
1K
P4
.001
P3
10K
10K
1K
P2
Q15
CD4019
IC18
CD4069
IC19
CD4001
IC20
TOP
CD4071
IC24
D16
D17
CD4069
IC25
CD4011
IC26
47K
.001
+15V
Q14
D18
CD4013
IC29
D19
.33
1K
10K
Q3
1K
100K
3300
10K
Q1
100K
D22
10K
10K
6.8K
.01
Q2
100
5.6K
D25
10K
D24
15K
100K
.01
D26
10K
47K
22K
470K
D28
D29
D27
10K
Q13
GND
680K
6.8K
Q5
3.3K
4.7K
15K
P1
4.7
10K
D30
100K
.22
1K
C14
10
-15V
10K
47K
2.2M
1K
14V
R3
100Ω
+14V
22K
22Ω
6.8K
Z3
P36
P35
P33
P32
+24V
P31
P30
Q8
P29
P28
P27
5V

BOARD "R"

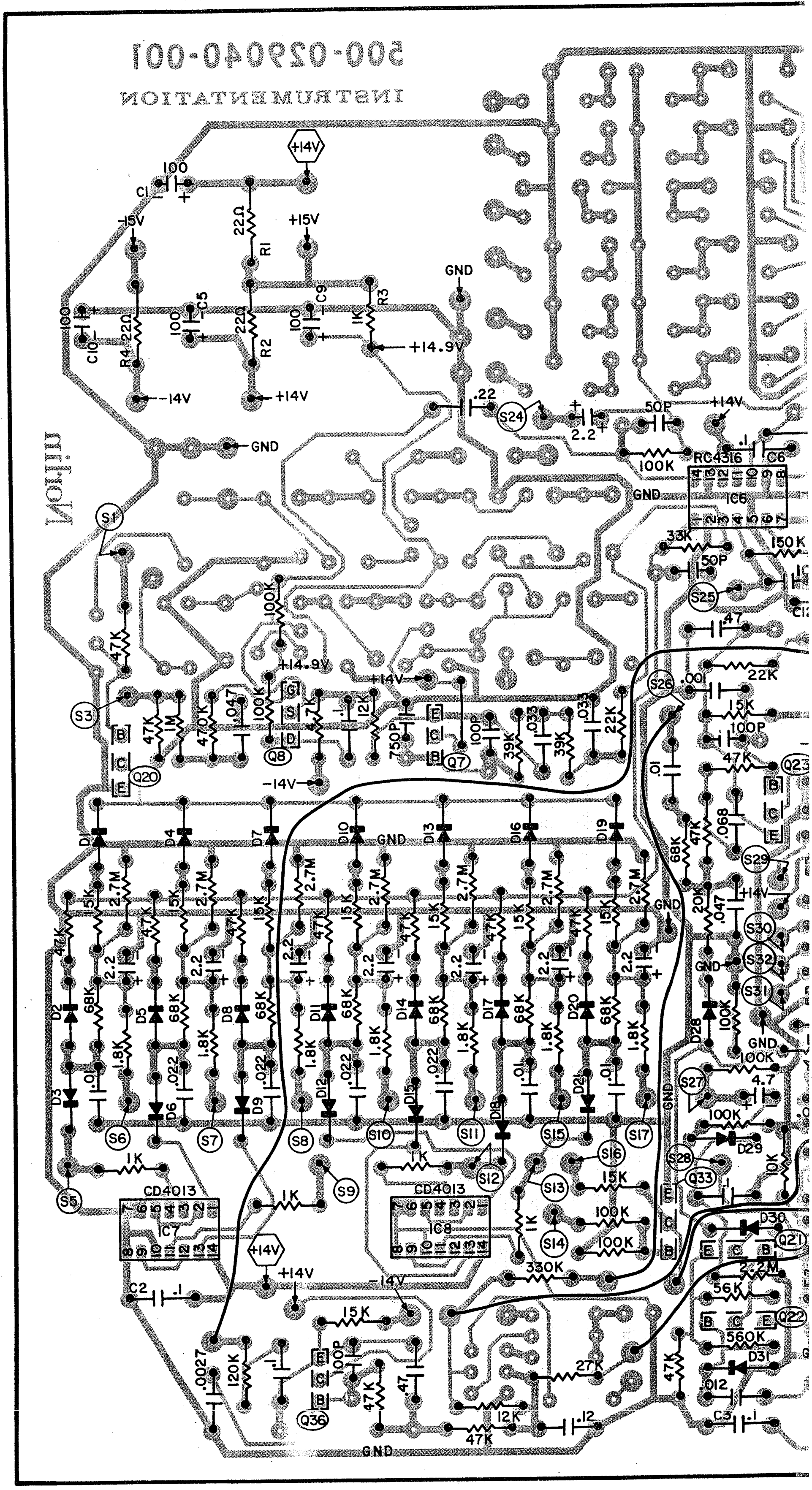

Inputs From Pedal Switches
C
C#
D
D#
E
F
F#
G
G#
A
A#
B
C2
Outputs to A.O.C. Drivers
B
C
C#
D
D#
E
F
F#
G
G#
A
A#
R5
IC6
MM5559
+14.5V
GND
.02
100K
6.8K
180K
22K
1K
D2
D3
D4
D5
D6
CD4011
IC12
CD4069
IC11
CD4013
IC16
CD4013
IC22
CD4013
IC21
10K
.047
470K
1.2K
150K
C7
.1
C3
100
R3
4.7Ω
3.3M
Q1
B
C
E
VR1
Chord Level
Adj
100Ω
100
R21
R22
R23
R24
R25
R26
R27
R28
+15V
-15V

C. F. G. / PEDAL

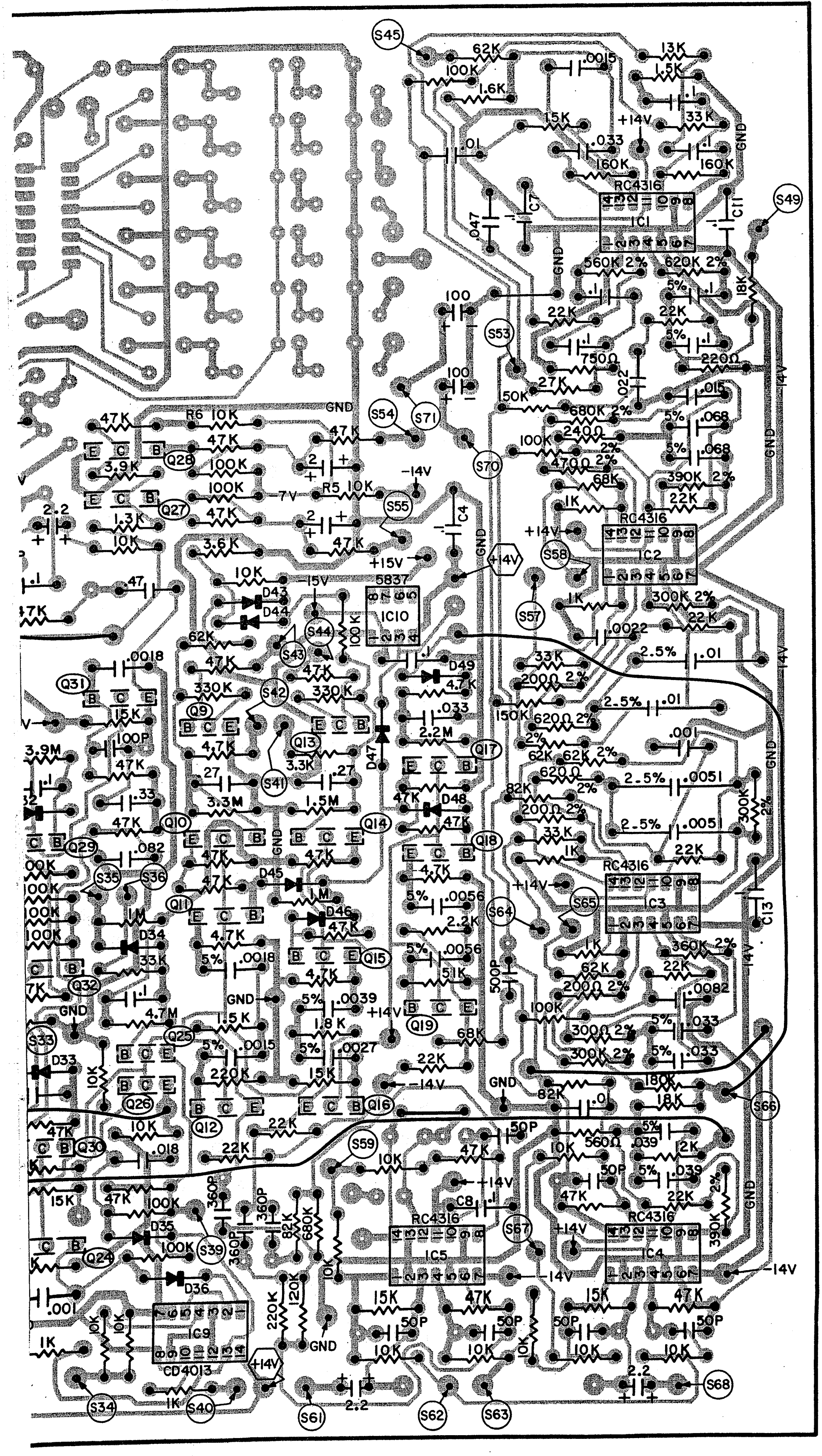

R3
+14.5V
GND
IC5
M147
C9
10K
1K
100K
GND
CD4085
IC10
D8
CD4025
IC9
22K
C11
1M
.022
GND
CD4069
IC7
L1
350uh
12P
200P
47K
470K
47P
.001
D7
R6
GND
R8
+15V
C1
+14V
R1
10Ω
220K
(14)
TOP
330K
8000P
CD4050
IC14
IC15
C8
270K
+14.5V
D37
CD4050
IC20
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
D19
D20
D21
D22
D23
D24
D25
D26
D27
D28
D29
D30
D31
D32
D33
D34
D35
D36
A2
C1
C2
C3
B1
B2
A#1
B3
A#2
A#3
A1
A3
G#1
G#2
G1
G2
F#1
F#2
F1
F2
E1
E2
D#1
D#2
D1
D2
C#1
C#2
From Magic Genie Keyswitches
CD4071
IC25
+14.5V
CD4071
IC24
6.8K
D42
D41
D40
D39
D38
100K
47K
180K
R19
R18
Y4
Y5
Y6
R17
R16
R15
R14

* Mounted to back of board.

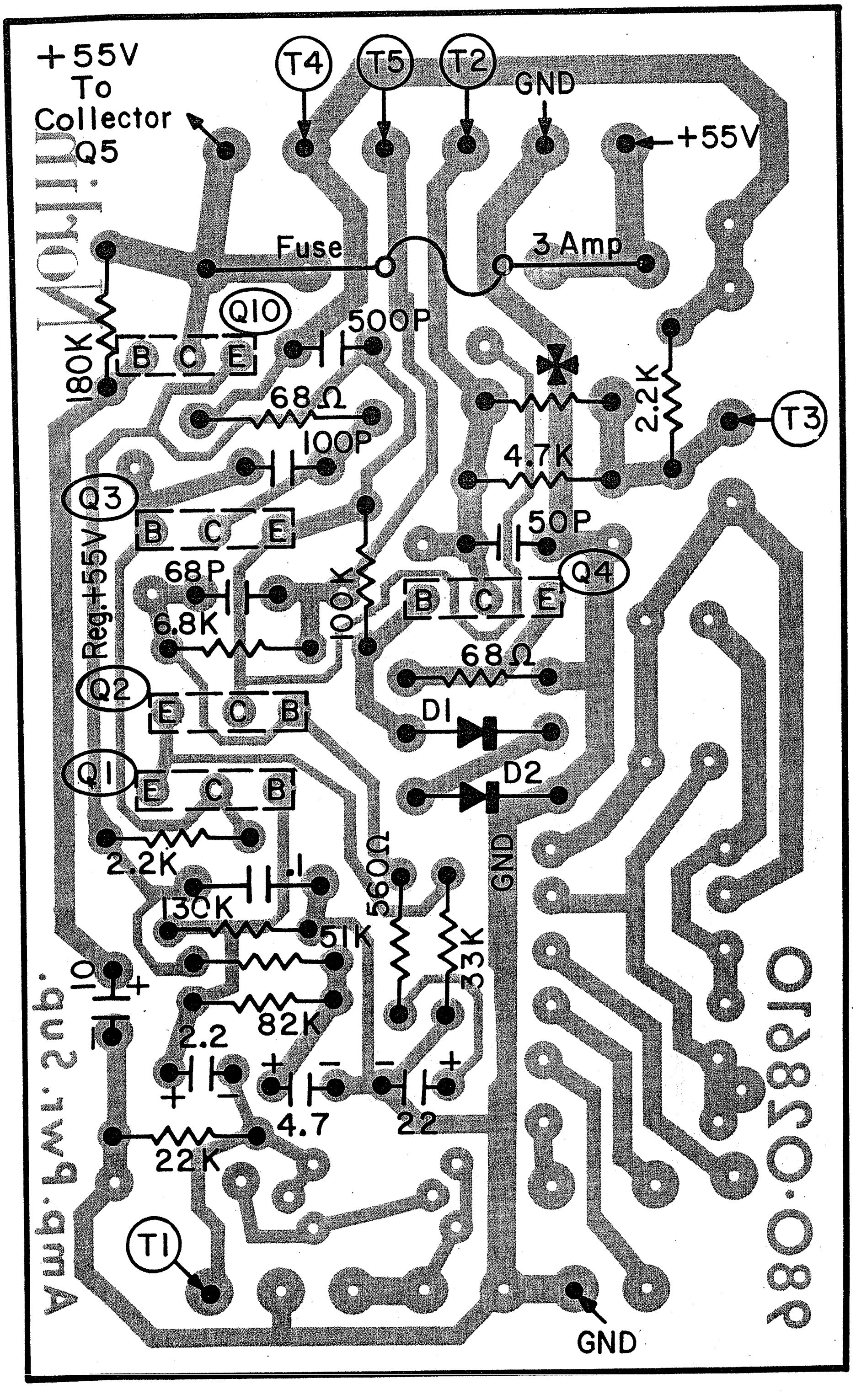
TOP BOARD "S"


500-029040-001
INSTRUMENTATION
+14V
+15V
-15V
-14V
+14.9V
GND
C1
100
C5
C9
C10
R1
R2
R3
R4
22Ω
1K
.22
S24
2.2
50P
100K
RC4316
IC6
C6
33K
150K
S25
S26
.001
22K
15K
100P
47K
Q23
.068
68K
S29
20K
.047
S30
S32
S31
D28
S27
4.7
D29
S28
Q33
10K
D30
Q21
2.2M
56K
Q22
560K
D31
.012
C3
S1
S3
S5
S6
S7
S8
S9
S10
S11
S12
S13
S14
S15
S16
S17
Q20
Q8
Q7
Q36
1M
.047
470K
100K
4.7K
12K
750P
39K
.033
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
D19
D20
D21
2.7M
1.8K
.022
.01
CD4013
IC7
IC8
330K
C2
.0027
120K
.47
27K
.12
GND

INSTRUMENTATION TOP

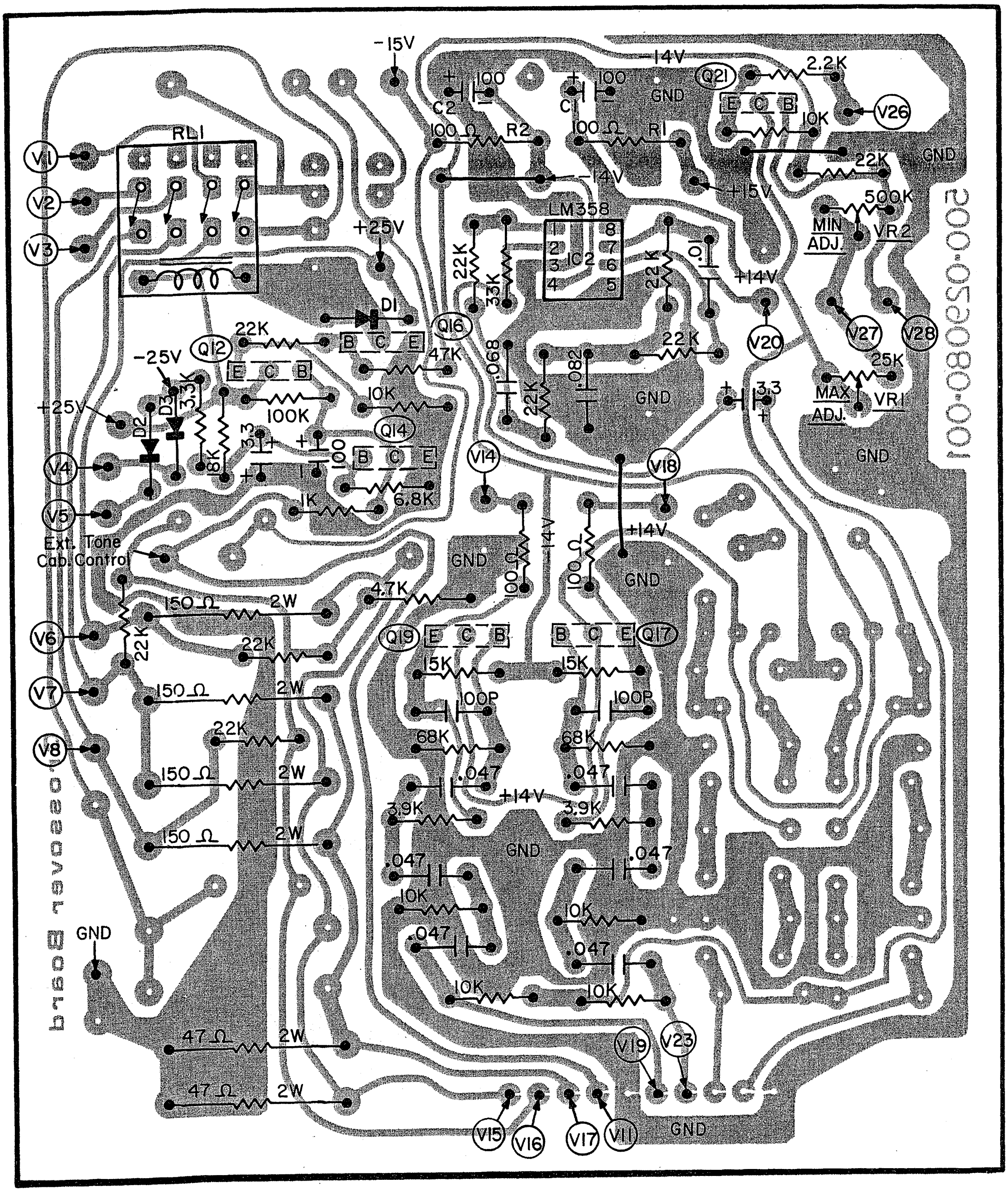

S45
62K
100K
1.6K
.0015
13K
1.5K
33K
+14V
15K
.01
.033
160K
160K
GND
RC4316
IC1
C7
C11
.047
S49
GND
560K 2%
620K 2%
18K
5%
100
22K
22K
5%
S53
750Ω
220Ω
100
27K
.022
-14V
150K
680K 2%
.015
5%
.068
5%
.068
S54
S71
S70
GND
R6 10K
47K
47K
47K
100K
Q28
3.9K
E C B
100K
-7V
R5 10K
-14V
2
Q27
2.2
1.3K
47K
10K
47K
3.6K
2
C4
S55
100K
2400
2%
4700 2%
68K
390K 2%
22K
1K
RC4316
+14V
IC2
S58
GND
+14V
+15V
10K
-15V
5837
IC10
D43
D44
S44
100K
62K
S43
.47
.0018
47K
330K
S42
330K
Q31
15K
Q9
B C E
E C B
Q13
D49
4.7K
.033
D47
2.2M
Q17
4.7K
3.3K
.27
S41
.27
3.3M
1.5M
3.9M
100P
47K
.33
47K
Q10
Q29
.082
S35
S36
Q14
GND
47K
47K
D45
47K
1M
Q11
D46
47K
1M
D34
33K
4.7K
5%
.0018
Q15
47K
D48
Q18
4.7K
5%
.0056
2.2K
5%
.0056
5.1K
S64
500P
Q32
GND
4.7M
Q25
1.5K
5%
.0015
GND
5%
.0039
1.8K
+14V
5%
.0027
Q19
68K
S33
D33
10K
220K
15K
Q26
Q12
Q16
-14V
22K
GND
S57
1K
.0022
33K
2000 2%
150K
620Ω 2%
2%
62K
62K 2%
6200
2%
82K
2000 2%
33K
1K
2.5%
.01
2.5%
.01
.001
2.5%
.0051
300K
2.5%
.0051
22K
RC4316
+14V
S65
IC3
C13
360K 2%
62K
22K
2000 2%
.0082
100K
3000 2%
5%
.033
300K 2%
5%
.033
82K
.01
180K
18K
S66
-14V
47K
10K
Q30
.018
22K
22K
S59
10K
50P
47K
10K
5600
5%
.039
12K
50P
5%
.039
15K
47K
100K
D35
360P
360P
360P
82K
680K
+14V
C8
RC4316
IC5
S67
+14V
47K
22K
390K
RC4316
IC4
2%
-14V
-14V
Q24
100K
S39
D36
10K
.001
1K
10K
10K
IC9
CD4013
220K
120K
GND
+14V
15K
50P
10K
47K
50P
10K
10K
15K
50P
10K
47K
50P
10K
2.2
2.2
S68
S34
1K
S40
S61
S62
S63

BOARD "T" AMPLIFIER


+55V
To
Collector
Q5
T4
T5
T2
GND
+55V
Fuse
3 Amp
Q10
500P
180K
B
C
E
68Ω
100P
2.2K
T3
4.7K
Q3
50P
Q4
68P
6.8K
100K
Reg.+55V
68Ω
Q2
D1
Q1
D2
2.2K
.1
560Ω
GND
130K
51K
10
+
33K
82K
2.2
4.7
22
22K
T1
GND

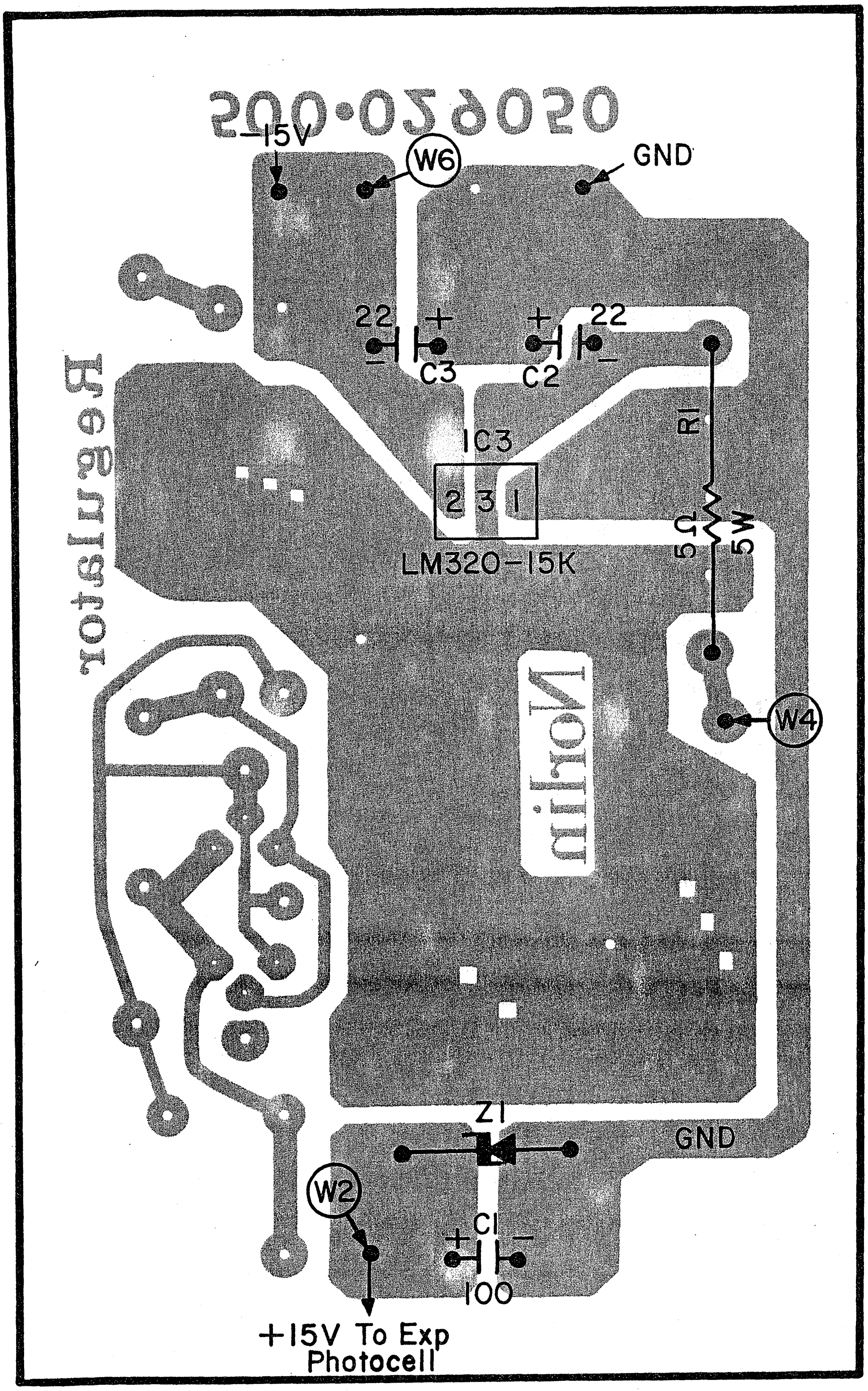
BOARD "V" CROSSOVER

TOP

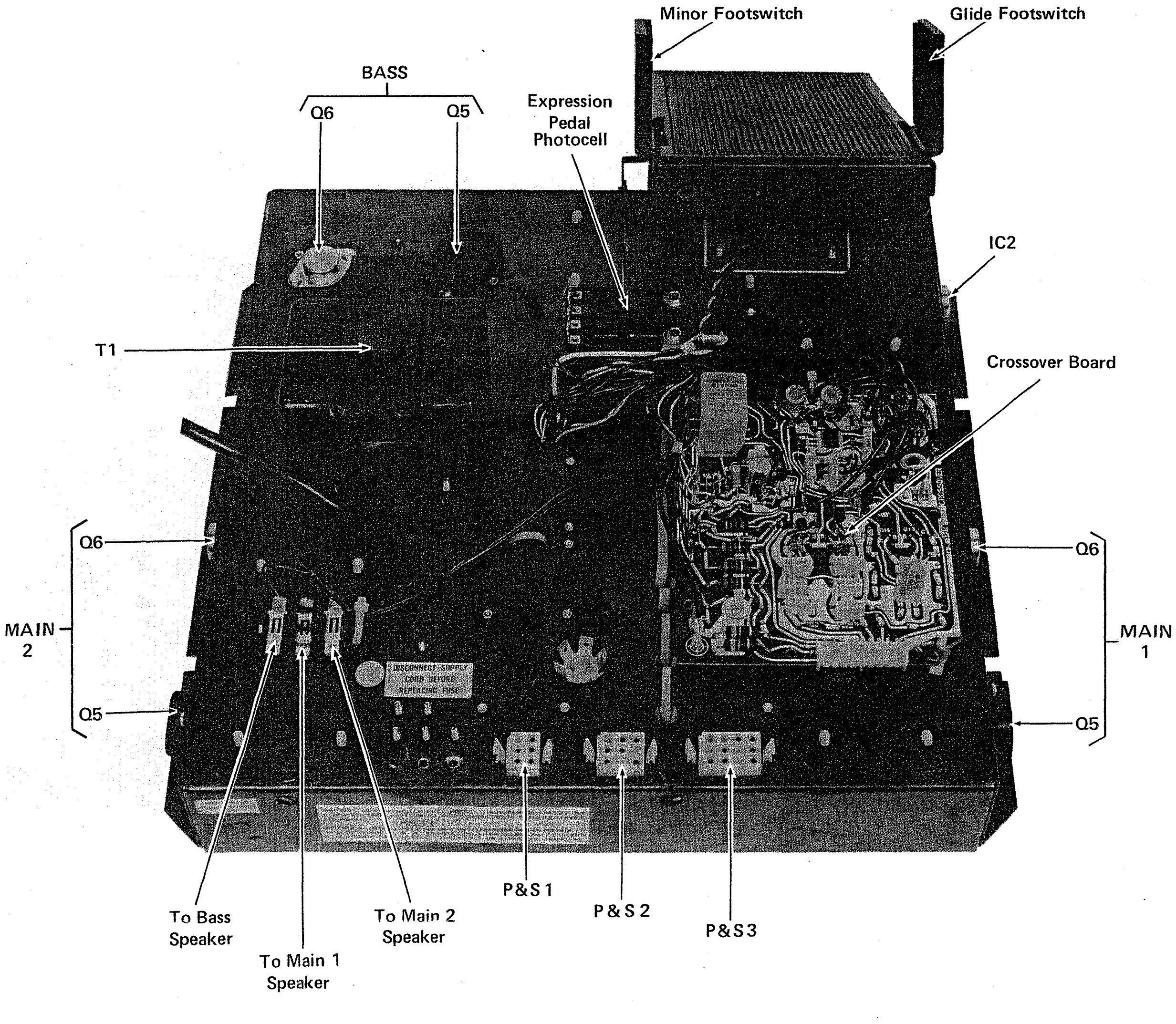


-15V
-14V
+
100
C2
100 Ω
R2
C1
100 Ω
R1
GND
Q21
E C B
2.2K
10K
V26
22K
GND
500K
MIN ADJ.
VR2
-14V
+15V
LM358
IC2
1 2 3 4
8 7 6 5
22K
33K
22K
.01
+14V
V20
V27
V28
25K
MAX ADJ.
VR1
GND
RL1
V1
V2
V3
+25V
D1
Q16
22K
B C E
47K
Q12
-25V
E C B
3.3K
10K
100K
Q14
D3
D2
+25V
V4
V5
18K
3.3
100
B C E
6.8K
1K
Ext. Tone Cab. Control
.068
22K
.082
22K
GND
+
3.3
+
V14
V18
100 Ω
-14V
100 Ω
+14V
GND
GND
4.7K
150 Ω
2W
22K
V6
22K
Q19
E C B
B C E
Q17
15K
15K
100P
100P
V7
150 Ω
2W
V8
22K
68K
68K
150 Ω
2W
.047
+14V
.047
3.9K
3.9K
150 Ω
2W
GND
.047
.047
10K
10K
.047
.047
10K
10K
GND
47 Ω
2W
47 Ω
2W
V19
V23
V15
V16
V17
V11
GND
GND
Crossover Board
500-029080-001

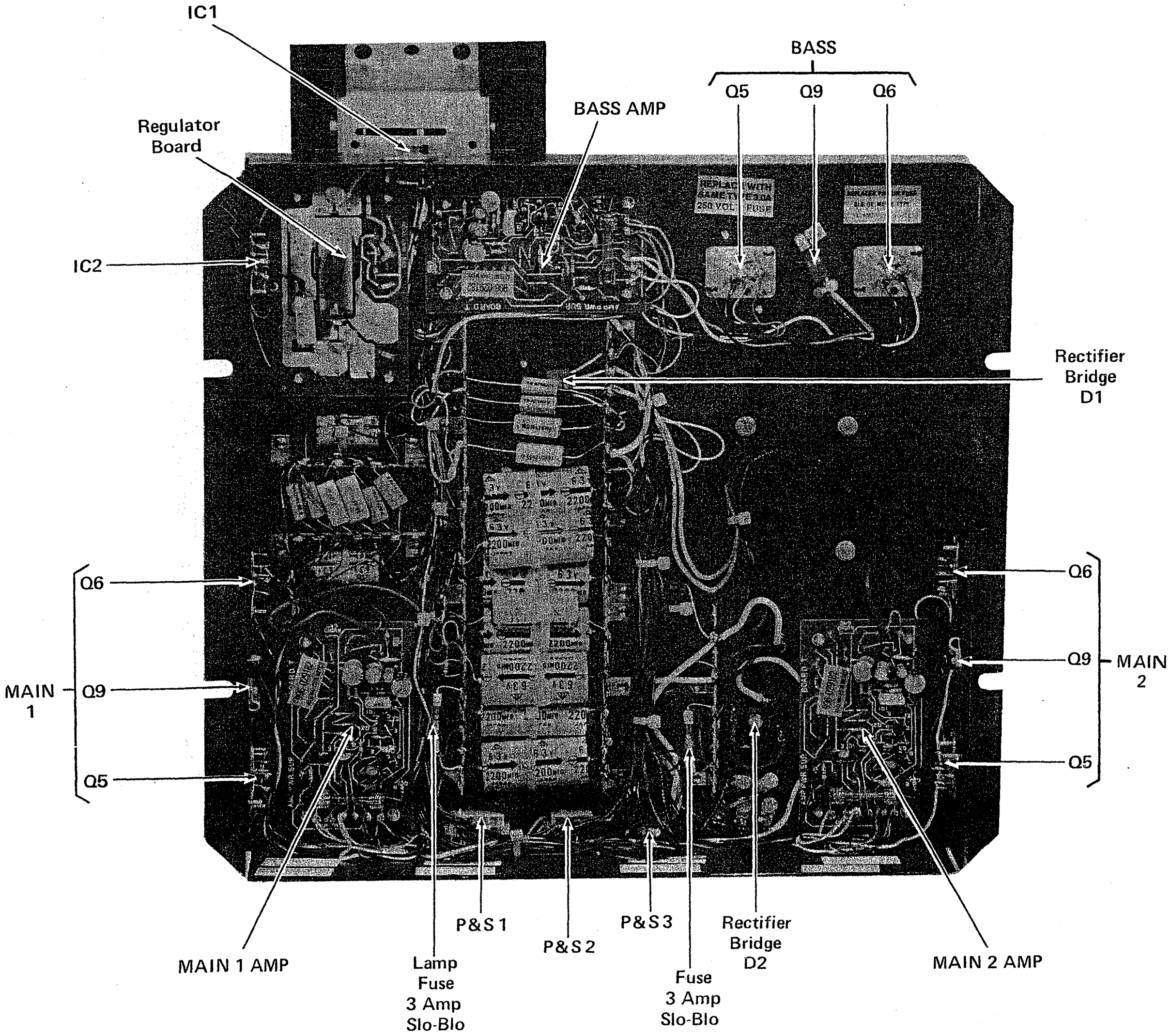
BOARD "W" REGULATOR


-15V
W6
GND
22
+
+
22
C3
C2
IC3
2 3 1
LM320-15K
R1
5Ω
5W
W4
Z1
GND
W2
C1
+
-
100
+15V To Exp
Photocell

POWER SUPPLY CHASSIS
[Top View]


Minor Footswitch
Glide Footswitch
BASS
Q6
Q5
Expression Pedal Photocell
IC2
T1
Crossover Board
Q6
MAIN 2
Q5
Q6
MAIN 1
Q5
P&S 1
P&S 2
P&S 3
To Bass Speaker
To Main 2 Speaker
To Main 1 Speaker
DISCONNECT SUPPLY CORD BEFORE REPLACING FUSE

POWER SUPPLY CHASSIS
[Bottom View]


IC1
BASS
Q5
Q9
Q6
BASS AMP
Regulator Board
IC2
Rectifier Bridge D1
Q6
MAIN 1
Q9
Q5
Q6
Q9
MAIN 2
Q5
P&S 1
P&S 2
P&S 3
Rectifier Bridge D2
MAIN 1 AMP
Lamp Fuse 3 Amp Slo-Blo
Fuse 3 Amp Slo-Blo
MAIN 2 AMP
REPLACE WITH SAME TYPE 3.0A 250 VOLT FUSE
2200
6.3